2006 Supplement to the

2002
Rim of the Pacific (RIMPAC) Programmatic Environmental Assessment

Revised Preliminary Final

April 2006

EXECUTIVE SUMMARY

Introduction

The objective of this Supplement to the Rim of the Pacific (RIMPAC) Programmatic Environmental Assessment ("RIMPAC PEA") is to analyze the potential environmental impacts from proposed RIMPAC 2006 training events. Section 1.5 of the RIMPAC PEA included the following requirements: that prior to each future RIMPAC, a review of the proposed activities would be compared to the analysis in the PEA to ensure all proposed activities are addressed. If new installations or facilities are proposed, significantly different training levels (personnel and equipment) and types of equipment are deployed, or the installation or range environmental sensitivities change, additional reviews or new analyses would be performed. Federal and state agencies would be briefed on the findings of each review and any new analyses. Based on satisfactory analyses, coordination, and review, the decision-maker would sign and publish a Finding of No Significant Impact for the RIMPAC Exercise.

Background

RIMPAC is a biennial, sea control/power projection fleet exercise that has been performed since 1968. RIMPAC 2006 will be the twentieth RIMPAC. The RIMPAC PEA was prepared in 2002 by Commander, THIRD Fleet for future RIMPAC Exercises. The RIMPAC PEA analyzed the potential environmental effects of RIMPAC, including in-port operations, command and control, aircraft operations, ship maneuvers, amphibious landings, troop movements, gunfire and missile exercises, submarine and antisubmarine exercises, mining and demolition activities, hulk sinking exercise, salvage, special warfare, and humanitarian operations. The RIMPAC PEA identified the Proposed Action as the set of training events and locations that could be used for future RIMPAC Exercises.

The RIMPAC PEA addressed all reasonably foreseeable activities in the particular geographical areas affected by the Proposed Action and focused on the activities with reasonable potential for impacts on the environment. The environmental impacts were analyzed for the following resource areas: air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, land use, noise, safety and health, socioeconomics, and water resources. The Commander, Pacific Fleet (COMPACFLT) concluded that RIMPAC 2002 and future RIMPAC Exercises would not significantly impact the environment based on the PEA analysis and the history of the previous RIMPAC Exercises that had been conducted prior to 2002.

In June 2004 a supplement ("2004 Supplement") was prepared to analyze a set of proposed RIMPAC training events that were not addressed in the RIMPAC PEA. Those exercises included mine countermeasures, gunnery exercises, demolition exercises, and an experimental oceanographic sensing platform. COMPACFLT concluded that RIMPAC, including the additional activities proposed for 2004 and subsequent RIMPAC Exercises, would not have a significant effect on the environment.

Scope of the RIMPAC 2006 Supplement to the 2002 RIMPAC PEA

Pursuant to Section 1.5 of the 2002 RIMPAC PEA, this Supplement compares the proposed RIMPAC 2006 activities with those in the RIMPAC PEA and the 2004 Supplement, provides analysis of potential environmental effects from proposed training events and new locations, and analyzes the cumulative impacts.

The RIMPAC 2006 Supplement also includes additional analysis related to mid-frequency active sonar. The training events being analyzed are not new and have taken place with no significant changes over the previous 19 RIMPAC exercises. However, new scientific information has led to the ability to quantitatively assess potential effects to marine mammals through the use of newly derived threshold criteria. As a result of scientific advances in acoustic exposure effects-analysis modeling on marine mammals, action proponents now have the ability to quantitatively estimate cumulative acoustic exposure on marine mammals. This RIMPAC 2006 Supplement documents an acoustic exposure effects-analysis on marine mammals that may be affected by the RIMPAC training events that use hull-mounted mid-frequency active tactical sonar.

RIMPAC Activities

The Proposed Action consists of the set of proposed RIMPAC training events that were identified at the RIMPAC Initial Planning Conference in August 2005, confirmed at the Mid Planning Conference in November 2005, and will be verified after the Final Planning Conference in March 2006. RIMPAC 2006 training events would occur within the locations included in the RIMPAC PEA and 2004 Supplement as shown on Table ES-1.

The potential environmental effects of all of the training events proposed for RIMPAC 2006 were analyzed in the RIMPAC PEA and the 2004 Supplement except for conducting the Non-Combatant Evacuation Operation (NEO) at Pacific Missile Range Facility (PMRF) and Niihau.

Methodology

In accordance with Section 1.5 of the RIMPAC PEA, prior to each subsequent RIMPAC, the Proposed Action will be compared to the analysis in the RIMPAC PEA. The RIMPAC 2006 Supplement includes a review of the RIMPAC 2006 activities compared to the RIMPAC PEA and the 2004 Supplement and also includes a description of the Antisubmarine Warfare (ASW) operations, and the ASW acoustic effects modeling completed for RIMPAC 2006.

Training Event Location Changes—The only change being proposed is the location for conducting the NEO (PMRF and Niihau). No new training events are proposed. In the RIMPAC PEA, the locations evaluated for the NEO included Marine Corps Base Hawaii, Marine Corps Training Area Bellows/Bellows Air Force Station, and Kahuku Training Area. For RIMPAC 2006, the primary NEO would take place at PMRF with similar, but smaller scale activities occurring on Niihau, similar to those previously analyzed for Special Warfare Operations activities on Niihau. The proposed area for the NEO at PMRF would include the beach at Majors Bay, located south of the Main Base and north of the PMRF housing area. The beach is used for large-scale amphibious training by Amphibious Task Force and Marine Expeditionary Unit elements.

Facilities and Procedures Review—New facilities have been constructed at RIMPAC training event locations since the RIMPAC PEA and the 2004 Supplement were completed. The potential use of these facilities for RIMPAC 2006 does not change the potential environmental effects as analyzed in the RIMPAC PEA and the 2004 Supplement. The procedures at each location for implementing RIMPAC training events were reviewed and are still valid as described in the RIMPAC PEA and 2004 Supplement. The procedures for utilization of the Makua Military Reservation are consistent with current range management standard operating procedures. The actions at Makua are currently being evaluated in the Draft Environmental Impact Statement (EIS) for Military Training Activities at Makua Military Reservation, Hawaii (U.S. Army 2005). There are currently no plans to use Makua for RIMPAC 2006.

Affected Environment Review—The affected environment at most RIMPAC training event locations remains the same as described in the RIMPAC PEA and 2004 Supplement. The affected environment at the potential NEO locations at PMRF and Niihau has not changed since the RIMPAC PEA and 2004 Supplement were prepared. The underwater areas where ASW training occurs during RIMPAC are also unchanged; however, additional detail regarding the affected environment will be presented to support new methods for analyzing potential effects of mid-frequency active tactical sonar. The Hawaiian Islands Operating Area is now used to define the outer limits of the ocean areas used during RIMPAC.

The delineation of the “sensitive ecological areas” at Kahuku Military Training Area has changed since preparation of the RIMPAC PEA based on new information in the Stryker Brigade EIS (U.S. Army 2004). As described in Section 4.1.12, pg 4-21 of the RIMPAC PEA, the Special Warfare Operations, Humanitarian Assistance/Disaster Relief, and Humanitarian Assistance Operation/Non-Combatant Evacuation Operation (HAO/NEO) activities would involve training events that are non-intrusive in nature, and all participants would follow the training guidelines set forth in the Final Ecosystem Management Plan Report, Oahu Training Areas (U.S. Army Garrison, Hawaii, and U.S. Army Corps of Engineers, 1998) and therefore there would be no impacts to biological resources. Therefore, the change in the delineation of the “sensitive ecological areas” does not affect the conclusions as to environmental effects from the RIMPAC PEA.

Antisubmarine Warfare (ASW)—The types of ASW training conducted during RIMPAC include the use of ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices. While ASW events could occur throughout the approximate 210,000 square nautical miles (nmi) of the Hawaiian Islands Operating Area, most events would occur within the approximate 46,000 square nmi of these six areas that were used for analysis as being representative of the marine mammal habitats and the bathymetric, seabed, wind speed, and sound velocity profile conditions within the entire Hawaiian Islands Operating Area. For purposes of this analysis, all likely RIMPAC ASW events were modeled as occurring in these six areas.

As a combined force, submarines, surface ships, and aircraft will conduct ASW against opposition submarine targets. Submarine targets include real submarines, target drones that simulate the operations of an actual submarine, and virtual submarines interjected into the training events by exercise controllers. ASW training events are complex and highly variable. For RIMPAC, the primary event involves a Surface Action Group (SAG), consisting of one to five surface ships equipped with sonar, with one or more helicopters, and a P-3 aircraft searching for one or more submarines. There will be approximately four SAGs for RIMPAC 2006. For the purposes of analysis, each SAG event is counted as an ASW operation. There would be approximately 44 ASW operations during RIMPAC with an average event length of approximately 12 hours. One or more ASW events may occur simultaneously within the Hawaiian Islands Operating Area. A total of 532 training hours were modeled for RIMPAC acoustic exposures. This total includes all potential ASW training that is expected to occur during RIMPAC.

Results

Biological Resources

PMRF, Kauai—Procedures for implementing the NEO would be similar to the Amphibious Landing Exercise analyzed in the RIMPAC PEA, Section 4.1.1.3, pg 4-3, but the NEO involves fewer people and much less equipment; therefore, the impacts would be insignificant. Within 1 hour prior to initiation of the landing activities, landing routes and beach areas would be determined to be clear of marine mammals and sea turtles. If any are seen, the exercise would be delayed until the animals leave the area.

Niihau—The NEO activities at Niihau would be similar to Special Warfare Operations training events analyzed in the RIMPAC PEA, Section 4.1.2.1, pg 4-11. Special Warfare Operations training events on Niihau would utilize existing openings, trails, and roads. Helicopter landings would be in areas designated as suitable and absent of biological resources. Therefore, no impacts to biological resources would be anticipated.

Open Ocean Areas—An analysis was conducted for RIMPAC 2006, modeling the potential interaction of hull mounted mid-frequency active tactical sonar with marine mammals in the Hawaiian Islands Operating Area. The modeled estimate indicates the potential for a total of 33,331 Level B harassment exposures. Level B harassment in the context of military readiness activities is defined as any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered. This estimate of total predicted marine mammal sound exposures constituting Level B harassment, is presented without consideration of standard protective operating procedures. There are no predicted marine mammal sonar exposures that would result in injury.

The sound energy level threshold for determining when an exposure constitutes Level B harassment was determined in consultation with the National Marine Fisheries Service (NMFS) as a cooperating agency. Although Navy believes there is a firm scientific basis for setting this threshold at 190 decibels (dB) re 1 μPa^2-s Energy Flux Density Level (EL) (see Section 4.2.1 for a full discussion), the use of the 173 dB re 1 μPa^2-s EL metric as threshold was required by NMFS because NMFS believes that the threshold should not be based solely on data gathered from captive animals, but also from data gathered in studies of wild animals.

There are no density or abundance figures for blue whales, North Pacific right whales, or minke whales. Blue whales and North Pacific right whales are rare in occurrence and are not likely to be encountered during RIMPAC activities. Minke whales are seasonal in the Hawaiian Islands and should not be present during the summer months when RIMPAC occurs. Like minke whales, the humpback whale is not present in the Hawaiian Islands Operating area in July and therefore was not included in the model.

As noted previously, modeling was undertaken to assess potential effects by estimating the numbers of marine mammals that could be affected by the activities associated with the use of hull-mounted mid-frequency active tactical sonar during RIMPAC. The results from that modeling do not represent a guarantee of the interaction of sound and mammals since there are factors that will occur relative to the modeled parameters, such as the mitigating effect of standard operating procedures serving as protective measures. These procedures include measures such as decreasing the source level and then shutting down active tactical sonar operations when marine mammals are encountered in the vicinity of a training event. Although these protective measures are standard operating procedure, their use is also reinforced through promulgation of an Environmental Annex to the Operational Orders for the RIMPAC Exercise.

It is likely that Navy ships will detect marine mammals in their vicinity. While conducting the exercise, Navy ships always have two, although usually more, personnel on watch serving as lookouts. In addition to the qualified lookouts, the bridge team is present that at a minimum also includes an Officer of the Deck and one Junior Officer of the Deck whose responsibilities also include observing the waters in the vicinity of the ship. At night, personnel engaged in ASW events may also employ the use of night vision goggles and infra-red detectors, as appropriate, which can also aid in the detection of marine mammals. Passive acoustic detection of vocalizing marine mammals is also used to alert bridge lookouts to the potential presence of marine mammals in the vicinity.

The endangered species that may be affected by the Proposed Action include the North Pacific right whale (*Eubalaena japonica*), the humpback whale (*Megaptera novaeangliae*), the sei whale *(Balaenoptera borealis),* the fin whale (*Balaenoptera physalus*), the blue whale (*Balaenoptera musculus*), the sperm whale (*Physeter macrocephalus),* the Hawaiian monk seal (*Monachus schauinslandi*), the loggerhead sea turtle (*Caretta caretta*), the green sea turtle (*Chelonia mydas),* the hawksbill sea turtle (*Eretmochelys imbricata*), the leatherback sea turtle (*Dermochelys coriacea*), and the olive ridley sea turtle (*Lepidochelys olivacea*). As such the Navy is consulting with National Oceanic and Atmospheric Administration (NOAA) Fisheries under Section 7 of the Endangered Species Act.

Based on seasonal distribution patterns and habitat preferences, the humpback whale, the blue whale, and the North Pacific right whale are not expected to be encountered during the timeframe of the Proposed Action, and thus were not included in the acoustic effects exposure model.

Without consideration of protective measures, acoustic effects modeling indicated that up to 34 sperm whales, 3 fin whales, 1 sei whale, and 1 monk seal may be exposed to sonar signals that exceed a Marine Mammal Protection Act (MMPA) Temporary Threshold Shift (TTS) harassment threshold of 195 dB re 1 μPa^2-s EL. Approximately 1,451 sperm whales, 61 fin whales, and 27 sei whales may be exposed to sonar signals above 173 dB re 1 μPa^2-s EL.

Cultural Resources

Niihau—As stated in the RIMPAC PEA, section 4.1.2.2, pg 4-11, no known traditional cultural properties are located within the U.S. Navy's Mobile Operations Area on Niihau. Exercise participants would be briefed on the need to promptly notify Navy Region personnel if any cultural resources are found so appropriate coordination could be initiated.

Conclusions

As summarized in the preceding paragraphs, the Proposed Action and alternatives were compared to the analysis in the RIMPAC PEA. This comparison included a review of the RIMPAC 2006 activities compared to the RIMPAC PEA and the 2004 Supplement. The facilities and procedures for implementing RIMPAC were also reviewed, and the affected environment was reviewed to identify any changes. Based on those reviews and the analysis presented in the RIMPAC PEA and 2004 Supplement, no significant impacts to air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, land use, noise, safety and health, socio-economics, or water quality would occur as a result of implementing the Proposed Action or alternatives. In addition, this Supplement includes the ASW acoustic effects modeling of hull mounted mid-frequency active tactical sonar completed for RIMPAC 2006. Based on the analysis presented in this supplement, no significant impacts on biological resources would occur as a result of implementing the Proposed Action or alternatives.

This Supplement therefore concludes that RIMPAC 2006 would result in:

- No significant impacts in accordance with the National Environmental Policy Act (NEPA).
- No significant harm to resources in the global commons under Executive Order (EO) 12114.
- No significant impacts to cultural resources. Consistent with 36 CFR 800.4(a)(1) and 800.2(o), the U.S. Navy has determined that RIMPAC does not constitute an undertaking in the sense that no new activities are planned. Instead, it is simply the coordination of ongoing training events that have been previously conducted and would be combined into one exercise for RIMPAC 2006.
- No destruction or adverse modification of any critical habitat in accordance with the Endangered Species Act (ESA). RIMPAC ASW training events may affect sperm whales, fin whales, sei whales, and monk seals. As such the Navy is consulting with NOAA Fisheries under Section 7 of the ESA.
- A potential for Level B harassment of marine mammals. However, effects to marine mammal species or stocks from RIMPAC ASW training events would be negligible. Due to the fact that the model predicts incidental harassment of marine mammals, the Navy has prepared a Request for Incidental Harassment Authorization for the incidental harassment of marine mammals resulting from the use of hull mounted mid-frequency active tactical sonar in training events conducted during the RIMPAC Exercise.
- No adverse impact to Essential Fish Habitat in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA).
- No conflict with the Hawaii Coastal Zone Management Program, Chapter 205A, Hawaii Revised Statutes, or State of Hawaii Coastal Zone Management Polices and approved

related resource management programs; or through a prior consistency determination process, the U.S. Navy has taken steps to ensure that these activities are consistent, to the maximum extent practicable, with the approved state management programs. Consistent with the Coastal Zone Management Act of 1972, individual training events that would occur as a part of RIMPAC within U.S. Territorial Waters have been previously evaluated through preparation and subsequent State of Hawaii review of the RIMPAC 98 EA, RIMPAC 00 EA, RIMPAC PEA, and RIMPAC 04 Supplement. Through the review process the training events have been determined to pose no conflict.

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Table ES-1 Potential RIMPAC Training Event Locations

Training Events

Service	Location	Island			AAW				ASUW / ASW		MIW				ASUW											
												MCM														
			IN-PORT/SUPPORTEX	C2	AIROPS	SAMEX	AAMEX	ASMEX	SSMEX	ASWEX	MINEX	SMWEX	AMWEX	UMWEX	STWEX, CASEX	GUNNEX	SINKEX	LFX	HAO/NEO	HA/DR	SPECWAROPS	DEMO	SALVAGE OPS	AMPHIBEX	SUBOPS	OTHER
U.S. Navy	Pacific Missile Range Facility*	Kauai																	06		PEA	PEA		PEA		
	Niihau	Niihau																	06		PEA					
	Kaula	Kaula													PEA											
	Pearl Harbor**	Oahu	PEA	PEA	PEA																PEA	04	PEA			
	Iroquois Land/Underwater Range	Oahu																			PEA	PEA				
	Puuloa Underwater Range – Pearl Harbor	Oahu																			PEA	PEA	PEA			
	Barbers Point Underwater Range	Oahu																			PEA	PEA				
	Coast Guard AS Barbers Point/ Kalaeloa Airport	Oahu			PEA																PEA					
	PMRF Warning Areas#	Ocean Areas				PEA	PEA	PEA	PEA	PEA	PEA				PEA	PEA	PEA				PEA	PEA			PEA	
	Oahu Warning Areas#	Ocean Areas				PEA	PEA			PEA						PEA					PEA	PEA			PEA	
	Open Ocean Areas#	Ocean Areas								PEA		04	04	04							PEA	PEA			PEA	04
	U.S. Command Ship	Ocean Areas		PEA																						
U.S. Marines	Marine Corps Base Hawaii	Oahu		PEA	PEA									04					PEA	PEA	PEA			PEA		
	Marine Corps Training Area Bellows	Oahu																	PEA	PEA	PEA			PEA		
U.S. Air Force	Hickam Air Force Base	Oahu		PEA	PEA																PEA					
U.S. Army	Kahuku Training Area	Oahu																	PEA	PEA	PEA					
	Makua Military Reservation	Oahu																PEA			PEA					
	Dillingham Military Reservation	Oahu																			PEA					
	Wheeler Army Airfield	Oahu		PEA	PEA																PEA					
	K-Pier, Kawaihae	Hawaii																			PEA			PEA		
	Bradshaw Army Airfield	Hawaii		PEA	PEA																PEA					
	Pohakuloa Training Area	Hawaii																PEA			PEA					
State	Keehi Lagoon	Oahu																					PEA			

* Includes Port Allen and Makaha Ridge

** Includes Ford Island and all other areas within the harbor.

These areas are included in the Hawaiian Islands Operating Area. The Hawaiian Islands Operating Area is now used to define the outer limits of the ocean areas used during RIMPAC.

RIMPAC PEA — Added RIMPAC 04 Supplement — Added RIMPAC 06 Supplement

Training Events:

AAMEX	Air-to-Air Missile Exercise	C2	Command and Control
AAW[1]	Anti-Air Warfare	DEMO	Demolition Exercise
AIROPS	Aircraft Operations	GUNNEX	Gunnery Exercise
AMPHIBEX	Amphibious Landing Exercise	HA/DR	Humanitarian Assistance/Disaster Relief
AMWEX	Air Mine Warfare Exercise	HAO/NEO	Humanitarian Assistance Operation/ Non-Combatant Evacuation Operation
ASMEX	Air-to-Surface Missile Exercise	IN-PORT	In-port Briefings and Activities
ASUW[2]/ASW[3]	Anti-Surface Warfare/Anti-Submarine Warfare Exercise	LFX	Live Fire Exercise
ASWEX	Anti-Submarine Warfare Exercise *(term used in RIMPAC PEA)*	MCM	Mine Countermeasures
CASEX	Close Air Support	MINEX	Mining Exercise
		MIW[4]	Mine Warfare
SALVAGE OPS	Salvage Operations	SPECWAROPS	Special Warfare Operations
SAMEX	Surface-to-Air Missile Exercise	SSMEX	Surface-to-Surface Missile
SINKEX	Sinking Exercise	STWEX	Strike Warfare Exercise
SMWEX	Ship Mine Warfare Exercise	SUBOPS	Submarine Operations
SUPPORTEX	In-Port Support Exercise	UMWEX	Underwater Mine Warfare Exercise

Note: Since the publication of the RIMPAC PEA, new terminology and/or categories of exercises have come into use. They are as follows:

[1] **AAW** includes AIROPS, SAMEX, AAMEX, and ASMEX

[2] **ASUW** includes GUNNEX, SSMEX, and ASWEX

[3] **ASW** includes SSMEX and ASWEX

[4] **MIW** encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mining by others and includes SMWEX, AMWEX, and UMWEX.

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ACRONYMS AND ABBREVIATIONS

ADC	Acoustic Device Countermeasures
ASW	Antisubmarine Warfare
CFR	Code of Federal Regulations
COMPACFLT	Commander, Pacific Fleet
CRRC	Combat Rubber Reconnaissance Craft
CV	Coefficient of Variation
dB	Decibels
DoD	Department of Defense
DoN	Department of the Navy
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EL	Energy Flux Density Level
EO	Executive Order
ESA	Endangered Species Act
GRAB	Gaussian Ray Bundle
HA/DR	Humanitarian Assistance/Disaster Relief
HAO/NEO	Humanitarian Assistance Operation/Non-Combatant Evacuation Operation
Hz	Hertz
kHz	Kilohertz
km	Kilometer
IWC	International Whaling Commission
LCAC	Landing Craft, Air-Cushion
LCU	Landing Craft, Utility
m	Meter
MF	Mid-Frequency
MMPA	Marine Mammal Protection Act
µPa	Micropascal
MRA	Marine Resource Assessment
ms	Milliseconds
NEO	Non-Combatant Evacuation Operation
NEPA	National Environmental Policy Act
nmi	Nautical Miles
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OEIS	Overseas Environmental Impact Statement
OPNAVINST	Naval Operations Instruction
PEA	Programmatic Environmental Assessment
PMAP	Protective Measures Assessment Protocol
PMRF	Pacific Missile Range Facility
PTS	Permanent Threshold Shift

RHIB	Rigid Hull Inflatable Boats
RIMPAC	Rim of the Pacific
SAG	Surface Action Group
SOP	Standard Operating Procedures
SPL	Sound Pressure Level
SPECWAROPS	Special Warfare Operations
TS	Threshold Shift
TTS	Temporary Threshold Shift
USC	United States Code
USFWS	United States Fish and Wildlife Service

1.0 INTRODUCTION

The objective of this Supplement to the Rim of the Pacific (RIMPAC) Programmatic Environmental Assessment ("RIMPAC PEA") is to analyze the potential environmental effects from proposed RIMPAC 2006 training events. Section 1.5 of the RIMPAC PEA included the following requirements: that prior to each future RIMPAC, a review of the proposed activities would be compared to the analysis in the PEA to ensure all proposed activities are addressed. If new installations or facilities are proposed, significantly different training levels (personnel and equipment) and types of equipment are deployed, or the installation or range environmental sensitivities change, additional reviews or new analyses would be performed. Federal and state agencies would be briefed on the findings of each review and any new analyses. Based on satisfactory analyses, coordination, and review, the decision-maker would sign and publish a Finding of No Significant Impact for the RIMPAC Exercise.

1.1 BACKGROUND

RIMPAC is a biennial, sea control/power projection fleet exercise that has been performed since 1968. RIMPAC 2006 will be the twentieth RIMPAC. A RIMPAC PEA was prepared in 2002 by Commander, THIRD Fleet for future RIMPAC Exercises. The RIMPAC PEA analyzed the potential environmental effects of RIMPAC, including in-port operations, command and control, aircraft operations, ship maneuvers, amphibious landings, troop movements, gunfire and missile exercises, submarine and antisubmarine exercises, mining and demolition activities, hulk sinking exercise, salvage, special warfare, and humanitarian operations. The RIMPAC PEA identified the Proposed Action as the set of training events and locations that could be used for future RIMPAC Exercises.

The RIMPAC PEA addressed all reasonably foreseeable activities in the particular geographical areas affected by the Proposed Action and focused on the activities with reasonable potential for impacts on the environment. It was determined that because training events would take place at existing facilities and ranges routinely used for these types of activities, transportation and utilities would not be impacted and were not analyzed in the RIMPAC PEA. The environmental effects were analyzed for the following resource areas: air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, land use, noise, safety and health, socioeconomics, and water resources. The Commander, Pacific Fleet (COMPACFLT) concluded that RIMPAC 2002 and future RIMPAC Exercises would not significantly impact the environment based on the PEA analysis and the history of the previous RIMPAC Exercises that had been conducted prior to 2002 (see Appendix A, PEA FONSI, pg 6).

In June 2004 a supplement ("2004 Supplement") was prepared to analyze a set of proposed RIMPAC training events that were not addressed in the RIMPAC PEA. Those exercises included mine countermeasures, gunnery exercises, demolition exercises, and an experimental oceanographic sensing platform. COMPACFLT concluded that RIMPAC, including the additional activities proposed for 2004 and subsequent RIMPAC Exercises, would not have a significant effect on the environment (see Appendix A, 2004 Supplement FONSI, pg 5).

1.2 SCOPE OF THE RIMPAC 2006 SUPPLEMENT TO THE 2002 RIMPAC PEA

Pursuant to Section 1.5 of the 2002 RIMPAC PEA, this Supplement compares the proposed RIMPAC 2006 activities with those in the RIMPAC PEA and the 2004 Supplement, provides analysis of potential environmental effects from proposed training events and new locations, and analyzes the cumulative effects.

The RIMPAC 2006 Supplement also includes additional analysis related to mid-frequency active sonar. The training events being analyzed are not new and have taken place with no significant changes over the previous 19 RIMPAC exercises. However, new scientific information has led to the ability to quantitatively assess potential effects to marine mammals through the use of newly derived threshold criteria. As a result of scientific advances in acoustic exposure effects-analysis modeling on marine mammals, action proponents now have the ability to quantitatively estimate cumulative acoustic exposure on marine mammals given enough time between proposing the action and commencing the action. The RIMPAC 2006 Supplement documents an acoustic exposure effects-analysis on marine mammals that may be affected by the RIMPAC training events that use mid-frequency active tactical sonar.

This supplement was prepared in accordance with the following guidelines which provide the framework for the U.S. Navy and U.S. Department of Defense (DoD) officials to consider environmental consequences when making decisions on their actions: Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969; the Council on Environmental Quality *Regulations of Implementing the Procedural Provisions of the National Environmental Policy Act* (40 Code of Federal Regulations [CFR] 1500-1508); DoD Instruction 4715.9, *Environmental Effects in the United States of Department of Defense Actions*; Naval Operations Instruction (OPNAVINST) 5090.1B, *Environmental and Natural Resources Program Manual*; Army Regulation 200-2, *Environmental Effects of Army Actions*; U.S. Air Force Instruction 32-7061, *Environmental Impact Analysis*; and Marine Corps Order P 5090.2, *Environmental Compliance and Protection Manual;* the Endangered Species Act of 1973 (16 United States Code [USC] 1531 *et seq*.); The Marine Mammal Protection Act of 1972, as amended (16 USC 1361 *et seq*.). In addition, Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions,* addresses consideration of environmental effects in decisions for actions outside the United States or its territories.

This Supplement incorporates by reference the RIMPAC PEA and the 2004 Supplement. Appendix A includes the Finding of No Significant Impacts from those documents.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 ALTERNATIVE 1—PROPOSED ACTION

The Proposed Action consists of the set of proposed RIMPAC training events that were identified at the RIMPAC Initial Planning Conference in August 2005, confirmed at the Mid Planning Conference in November 2005, and verified after the Final Planning Conference in March 2006. RIMPAC 2006 training events would occur within the locations included in the RIMPAC PEA and 2004 Supplement, which are listed in Table 2-1.

The potential environmental effects of all of the training events proposed for RIMPAC 2006 were analyzed in the RIMPAC PEA and the 2004 Supplement except for conducting the Non-Combatant Evacuation Operation (NEO) at Pacific Missile Range Facility (PMRF) and Niihau. The proposed location for the NEO at PMRF was previously analyzed in the RIMPAC PEA for amphibious landings, and the Niihau locations for the NEO were previously analyzed in the RIMPAC PEA for special warfare operations, and as described later in this Supplement, no impacts were identified.

In accordance with Section 1.5 of the RIMPAC PEA, prior to each subsequent RIMPAC, the Proposed Action will be compared to the analysis in the RIMPAC PEA. The remainder of this chapter includes a review of the RIMPAC 2006 activities compared to the RIMPAC PEA and the 2004 Supplement (Section 2.1.1) and also includes a description of the Antisubmarine Warfare (ASW) operations, and the ASW acoustic effects modeling completed for RIMPAC 2006 (Section 2.1.2).

2.1.1 Review of RIMPAC 2006 Activities

To ensure the environmental analysis for all RIMPAC 2006 training events is still valid, the proposed RIMPAC 2006 training events and locations identified during the exercise planning conferences (held in August 2005 and November 2005) were compared to the RIMPAC PEA and the 2004 Supplement. Each activity was reviewed to see if new installations or facilities are proposed, if significantly different training levels (personnel and equipment) and types of equipment are proposed, or if the installation or range environmental sensitivities have changed. Table 2-2 summarizes that review. Where a change was identified the activity is described in further detail and analyzed in this supplement.

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Table 2-1 Potential RIMPAC Training Event Locations

Training Events

Service	Location	Island	IN-PORT/SUPPORTEX	C2	AAW				ASUW / ASW		MIW				ASUW			LFX	HAO/NEO	HA/DR	SPECWAROPS	DEMO	SALVAGE OPS	AMPHIBEX	SUBOPS	OTHER
												MCM														
					AIROPS	SAMEX	AAMEX	ASMEX	SSMEX	ASWEX	MINEX	SMWEX	AMWEX	UMWEX	STWEX, CASEX	GUNNEX	SINKEX									
U.S. Navy	Pacific Missile Range Facility*	Kauai																								
	Niihau	Niihau																								
	Kaula	Kaula																								
	Pearl Harbor**	Oahu																								
	Iroquois Land/Underwater Range	Oahu																								
	Puuloa Underwater Range – Pearl Harbor	Oahu																								
	Barbers Point Underwater Range	Oahu																								
	Coast Guard AS Barbers Point/ Kalaeloa Airport	Oahu																								
	PMRF Warning Areas#	Ocean Areas																								
	Oahu Warning Areas#	Ocean Areas																								
	Open Ocean Areas#	Ocean Areas																								
	U.S. Command Ship	Ocean Areas																								
U.S. Marines	Marine Corps Base Hawaii	Oahu																								
	Marine Corps Training Area Bellows	Oahu																								
U.S. Air Force	Hickam Air Force Base	Oahu																								
U.S. Army	Kahuku Training Area	Oahu																								
	Makua Military Reservation	Oahu																								
	Dillingham Military Reservation	Oahu																								
	Wheeler Army Airfield	Oahu																								
	K-Pier, Kawaihae	Hawaii																								
	Bradshaw Army Airfield	Hawaii																								
	Pohakuloa Training Area	Hawaii																								
State	Keehi Lagoon	Oahu																								

* Includes Port Allen and Makaha Ridge

** Includes Ford Island and all other areas within the harbor.

[#] These areas are included in the Hawaiian Islands Operating Area. The Hawaiian Islands Operating Area is now used to define the outer limits of the ocean areas used during RIMPAC.

RIMPAC PEA — Added RIMPAC 04 Supplement — Added RIMPAC 06 Supplement

Training Events:

AAMEX	Air-to-Air Missile Exercise	C2	Command and Control	SALVAGE OPS	Salvage Operations
AAW[1]	Anti-Air Warfare	DEMO	Demolition Exercise	SAMEX	Surface-to-Air Missile Exercise
AIROPS	Aircraft Operations	GUNNEX	Gunnery Exercise	SINKEX	Sinking Exercise
AMPHIBEX	Amphibious Landing Exercise	HA/DR	Humanitarian Assistance/Disaster Relief	SMWEX	Ship Mine Warfare Exercise
AMWEX	Air Mine Warfare Exercise	HAO/NEO	Humanitarian Assistance Operation/ Non-Combatant Evacuation Operation	SPECWAROPS	Special Warfare Operations
ASMEX	Air-to-Surface Missile Exercise			SSMEX	Surface-to-Surface Missile
ASUW[2]/ASW[3]	Anti-Surface Warfare/Anti-Submarine Warfare Exercise	IN-PORT	In-port Briefings and Activities	STWEX	Strike Warfare Exercise
		LFX	Live Fire Exercise	SUBOPS	Submarine Operations
ASWEX	Anti-Submarine Warfare Exercise	MCM	Mine Countermeasures	SUPPORTEX	In-Port Support Exercise
	(term used in RIMPAC PEA)	MINEX	Mining Exercise	UMWEX	Underwater Mine Warfare Exercise
CASEX	Close Air Support	MIW[4]	Mine Warfare		

Note: Since the publication of the RIMPAC PEA, new terminology and/or categories of exercises have come into use. They are as follows:

[1] **AAW** includes AIROPS, SAMEX, AAMEX, and ASMEX

[2] **ASUW** includes GUNNEX, SSMEX, and ASWEX

[3] **ASW** includes SSMEX and ASWEX

[4] **MIW** encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mining by others and includes SMWEX, AMWEX, and UMWEX.

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Table 2-2 RIMPAC Training Event Procedures and Existing Environment Review

Service	Location	New Training Event	Facilities/Standard Operating Procedures	Existing Environment
U.S. Navy	Pacific Missile Range Facility*	**NEO**	Several additional facilities constructed, procedures same	No change, review site for NEO
	Niihau	**NEO**	Areas same; procedures same	No change, review site for NEO
	Kaula	None	Procedures same	No change
	Pearl Harbor**	None	Facilities same, procedures same	No change
	Iroquois Land/Underwater Range	None	Facilities same, procedures same	No change
	Puuloa Underwater Range—Pearl Harbor	None	Area same, procedures same	No change
	Barbers Point Underwater Range	None	Area same, procedures same	No change
	Coast Guard Air Station Barbers Point/ Kalaeloa Airport	None	Facilities upgraded, procedures same	No change
	Pacific Missile Range Facility Warning Areas	None***	Area same, procedures same	No change
	Oahu Warning Areas	None***	Area same, procedures same	No change
	Open Ocean Areas	None***	Area same, procedures same	No change
	U.S. Command Ship	None	Procedures same	No change
U.S. Marines	Marine Corps Base Hawaii	None	Facilities same, procedures same	No change
U.S. Air Force	Hickam Air Force Base	None	Facilities same, procedures same	No change
	Marine Corps Training Area/Bellows Air Force Station	None	Facilities same, procedures same	No change
U.S. Army	Kahuku Training Area	None	Area same, procedures same	Change in delineation of sensitive ecological areas
	Makua Military Reservation	None	Facilities same, procedures same, revised range standard operating procedures	No change
	Dillingham Military Reservation	None	Facilities same, procedures same	No change
	Wheeler Army Airfield	None	Facilities same, procedures same	No change
	K-Pier, Kawaihae	None	Facilities same, procedures same	No change
	Bradshaw Army Airfield	None	Facilities same, procedures same	No change
	Pohakuloa Training Area	None	Area same, procedures same	No change
State	Keehi Lagoon	None	Area same, procedures same	No change

* Includes Port Allen and Makaha Ridge

** Includes Ford Island and all areas within the harbor

*** New acoustic effects modeling for previously analyzed events

NEO = Non-Combatant Evacuation Operation

2.1.1.1 Changed Training Event Locations

As shown in Table 2-2, the only change being proposed is the location for conducting the NEO (PMRF and Niihau). No new training events are proposed. In the RIMPAC PEA, the locations evaluated for the NEO included Marine Corps Base Hawaii, Marine Corps Training Area Bellows/Bellows Air Force Station, and Kahuku Training Area. For RIMPAC 2006, the primary NEO would take place at PMRF with similar, but smaller scale activities occurring on Niihau, similar to those previously analyzed for Special Warfare Operations activities on Niihau. The proposed area for the NEO at PMRF would include the beach at Majors Bay, located south of the Main Base and north of the PMRF housing area. The beach is used for large-scale amphibious training by Amphibious Task Force and Marine Expeditionary Unit elements. The HAO/NEO activities are described in the RIMPAC PEA (Section 2.2.15, pg 2-26) (Appendix E, 1) as follows:

- **Purpose—**to provide training in implementing humanitarian assistance in an increasingly hostile setting, ultimately requiring evacuation of personnel and troops.
- **Description—**Humanitarian Assistance Operation/Non-Combatant Evacuation Operation (HAO/NEO) training exercises involve approximately 150 personnel, troops, and specialists who initially provide assistance to civilians and then evacuate the civilians when necessary. This scenario could also be used to simulate a prisoner-of-war camp or place where people are interned. Groups could be interrogated and housed before shipping to another location. Direct action is also included in the HAO/NEO description because it involves a similar number of troops. The direct action exercise is much quicker and involves approximately 50 personnel and 150 troops who gain access to an area by boat or helicopter, secure the location, recover the mission target, and return to their units.
- **Assets—**HAO/NEO exercises use trucks, helicopters, Landing Craft, Air-Cushion (LCAC), Landing Craft Utility (LCU) and/or Combat Rubber Reconnaissance Craft (CRRC) to shuttle supplies. Evacuations may be made using helicopters, and/or LCAC vehicles. Direct actions may use CRRCs, Rigid Hull Inflatable Boats (RHIBs), trucks, and/or helicopters. Existing building and facilities are utilized to the extent practicable, but in some instances, tents and other temporary structures may be utilized.
- **Duration—**The HAO/NEO exercise lasts for approximately 4 days. The direct action exercise would be several hours.
- **Standard Procedures—**The HAO/NEO exercise typically takes place at existing buildings and facilities. For example, on Marine Corps Base Hawaii existing designated areas of Hale Koa/West Field beach would be used for helicopters and the LCAC landings. RIMPAC participants would use training overlays that identify the landing area and any nearby restricted areas or sensitive biological and cultural resource areas in the vicinity of the exercise.

The purpose, description, assets, and duration, as described above, are applicable for RIMPAC 2006. The standard procedures for PMRF and Niihau would include the following:

- **Standard procedures—**On PMRF, existing designated areas of Majors Bay beach previously used for RIMPAC amphibious landings would be used for helicopters and the LCAC landings as part of the NEO. RIMPAC participants would use training overlay maps that identify the NEO area and any nearby restricted areas or sensitive biological and cultural resource areas in the vicinity. On Niihau, the exercise would involve a limited number of participants (approximately 20), similar to the special warfare operations training events analyzed in the RIMPAC PEA (Section 2.2.17, pg 2-31) (Appendix E, 2). RIMPAC participants would use training overlay maps that identify the landing area and any nearby restricted areas.

2.1.1.2 Facilities and Procedures for Implementing RIMPAC

Facilities—New facilities have been constructed at RIMPAC training event locations since the RIMPAC PEA and the 2004 Supplement were completed. These facilities were completed for ongoing operations and were not constructed specifically to support RIMPAC. The potential use of these facilities for RIMPAC 2006 does not change the potential environmental effects at the training event locations as analyzed in the RIMPAC PEA and the 2004 Supplement.

Procedures—As discussed in previous RIMPAC EAs, RIMPAC Exercises are conducted on existing facilities that include numerous environmental protection measures implemented by each DoD service (Air Force, Army, Marine Corps, Navy, and National Guard). These environmental protection plans and procedures have been developed to minimize environmental effects and meet regulatory requirements in order to maximize range sustainability. Compliance with federal and state laws, regulations, and EOs is accomplished through Air Quality Permits, Air Installation Compatible Use Zones Studies, Cultural Resource Management Plans and Programmatic Agreements, Natural Resource Management Plans, Biological Assessments, Wildland Fire Management Plans, Environmental Compliance Assessments, Pollution Prevention Plans, Environmental Assessments (EA), and Environmental Impact Statements (EISs). Each DoD service also has environmental standard operating procedures (SOPs) that are set forth in service regulations, base orders, instructions, and manuals. RIMPAC-specific environmental protection measures are included in the RIMPAC Operational Order Environmental Annex. The 2004 RIMPAC Operational Order Environmental Annex is included for reference as Appendix B. The 2006 RIMPAC Operational Order is in process and will be completed prior to RIMPAC 2006.

The procedures at each location for implementing RIMPAC training events were reviewed and are still valid as described in the RIMPAC PEA and 2004 Supplement. The procedures for utilization of the Makua Military Reservation are consistent with current range management SOPs. The actions at Makua are currently being evaluated in the Draft EIS for Military Training Activities at Makua Military Reservation, Hawaii (U.S. Army 2005). There are currently no plans to use Makua for RIMPAC 2006.

2.1.1.3 Changes in the Affected Environment

The affected environment at most RIMPAC training event locations remains the same as described in the RIMPAC PEA and 2004 Supplement. The affected environment at the potential NEO locations at PMRF and Niihau has not changed since the RIMPAC PEA and 2004 Supplement were prepared. The underwater areas where ASW training occurs during RIMPAC is also unchanged; however, additional detail regarding the affected environment will be presented to support new methods for analyzing potential effects of mid-frequency active sonar. The Hawaiian Islands Operating Area is now used to define the outer limits of the ocean areas used during RIMPAC.

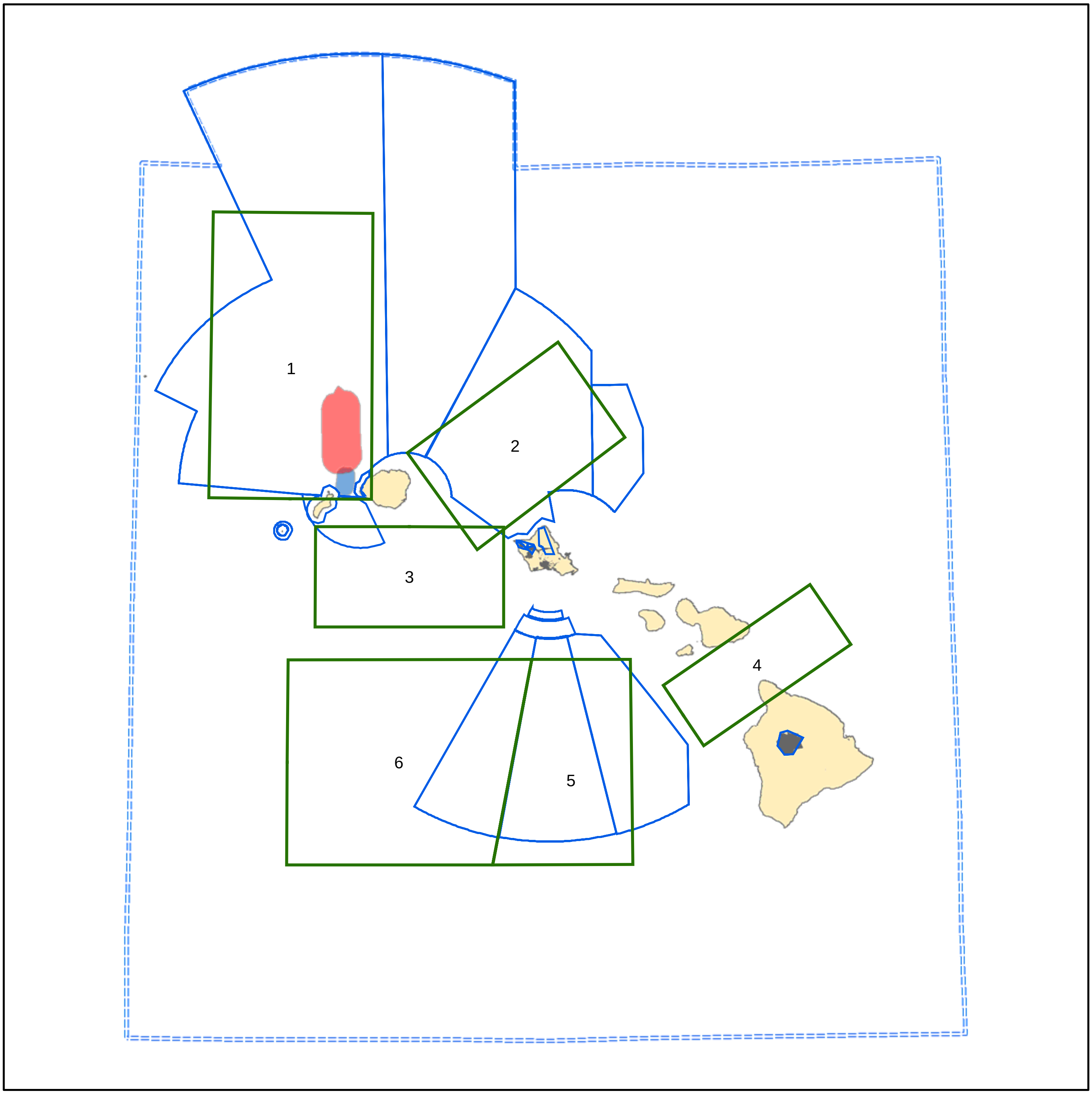
The delineation of the “sensitive ecological areas” at Kahuku Military Training Area has changed since preparation of the RIMPAC PEA based on new information in the Stryker Brigade EIS (U.S. Army 2004, Figures 7-26) (Appendix E, 3). As described in Section 4.1.12, pg 4-21 of the RIMPAC PEA (Appendix E, 4), the Special Warfare Operations (SPECWAROPS), Humanitarian Assistance/Disaster Relief (HA/DR), and HAO/NEO activities would involve training events that are non-intrusive in nature, and all participants would follow the training guidelines set forth in the Final Ecosystem Management Plan Report, Oahu Training Areas (U.S. Army Garrison, Hawaii, and U.S. Army Corps of Engineers, 1998a) and therefore there would be no impacts to biological resources. Therefore, the change in the delineation of the “sensitive ecological areas” does not affect the conclusions as to environmental effects from the RIMPAC PEA.

2.1.2 Antisubmarine Warfare

The types of ASW training conducted during RIMPAC include the use of ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices. Nearly all RIMPAC ASW training would occur in the six areas delineated in Figure 2-1. ASW events typically rotate between these six ASW areas and mid-frequency sonar may be operated for short amounts of time as forces move between them. While ASW events could occur throughout the approximate 210,000 square nautical miles (nmi) of the Hawaiian Islands Operating Area, most events would occur within the approximate 46,000 square nmi of these six areas that were used for analysis as being representative of the marine mammal habitats and the bathymetric, seabed, wind speed, and sound velocity profile conditions within the entire Hawaiian Islands Operating Area. For purposes of this analysis, all likely RIMPAC ASW events were modeled as occurring in these six areas.

2.1.2.1 ASW Training Operations During RIMPAC

RIMPAC 06 is scheduled to take place from June 26, 2006 through about July 28, 2006, with ASW exercises planned on 21 days. As a combined force, submarines, surface ships, and aircraft will conduct ASW against opposition submarine targets. Submarine targets include real submarines, target drones that simulate the operations of an actual submarine, and virtual submarines interjected into the training events by exercise controllers. ASW training events are complex and highly variable. For RIMPAC, the primary event involves a Surface Action Group (SAG), consisting of one to five surface ships equipped with sonar, with one or more



Explanation

RIMPAC ASW Acoustic Effect Modeling Areas
Hawaiian Islands Operating Area
Special Use Airspace
BSURE Hydrophones
BARSTUR Hydrophones
Military
Land Area

North

0 50 100 200 Nautical Miles

RIMPAC ASW Acoustic Exposure Modeling Areas

Hawaiian Islands

Figure 2-1

helicopters, and a P-3 aircraft searching for one or more submarines. There will be approximately four SAGs for RIMPAC 2006. For the purposes of analysis, each SAG event is counted as an ASW operation. There will be approximately 44 ASW operations during RIMPAC with an average event length of approximately 12 hours.

One or more ASW events may occur simultaneously within the Hawaiian Islands Operating Area. Each event was identified and modeled separately. If a break of more than 1 hour in ASW operations was likely to occur, then the subsequent event was modeled as a separate event. Training event durations ranged from 2 hours to 24 hours. A total of 532 training hours were modeled for RIMPAC acoustic exposures. This total includes all potential ASW training that is expected to occur during RIMPAC.

2.1.2.2 Active Acoustic Devices

Tactical military sonars are designed to search for, detect, localize, classify, and track submarines. There are two types of sonars, passive and active:

- Passive sonars only listen to incoming sounds and, since they do not emit sound energy in the water, lack the potential to acoustically affect the environment.
- Active sonars generate and emit acoustic energy specifically for the purpose of obtaining information concerning a distant object from the received and processed reflected sound energy.

Modern sonar technology has developed a multitude of sonar sensor and processing systems. In concept, the simplest active sonars emit omnidirectional pulses ("pings") and time the arrival of the reflected echoes from the target object to determine range. More sophisticated active sonar emits an omnidirectional ping and then rapidly scans a steered receiving beam to provide directional, as well as range, information. More advanced sonars transmit multiple preformed beams, listening to echoes from several directions simultaneously and providing efficient detection of both direction and range.

The tactical military sonars to be deployed in RIMPAC are designed to detect submarines in tactical operational scenarios. This task requires the use of the sonar mid-frequency (MF) range (1 kilohertz [kHz] to 10 kHz) predominantly.

The types of tactical acoustic sources that would be used in training events during RIMPAC are discussed in the following paragraphs.

- **Surface Ship Sonars.** A variety of surface ships participate in RIMPAC, including guided missile cruisers, destroyers, guided missile destroyers, and frigates. Some ships (e.g., aircraft carriers) do not have any onboard active sonar systems, other than fathometers. Others, like guided missile cruisers, are equipped with active as well as passive sonars for submarine detection and tracking. For purposes of the analysis, all surface ship sonars were modeled as equivalent to SQS-53 having the nominal source level of 235 decibels (dB) re 1 μPa^2-s @ 1 m. Since the SQS-53 hull mounted sonar is the U.S. Navy's most powerful surface ship hull mounted sonar, modeling this source is a conservative assumption tending towards an overestimation of potential exposures. Sonar ping transmission durations were modeled as lasting 1 second per ping and omnidirectional. Actual ping durations will be less than 1 second, which is a conservative assumption that will overestimate potential exposures. The SQS-53 hull mounted sonar transmits at center frequencies of 2.6 kHz and 3.3 kHz. Effects analysis modeling used frequencies that are required in tactical deployments such as those during RIMPAC. Details concerning the tactical use of specific frequencies and the repetition rate for the sonar pings is classified but was modeled based on the required tactical training setting.

- **Submarine Sonars.** Submarine sonars are used to detect and target enemy submarines and surface ships. Because submarine active sonar use is very rare and in those rare instances, very brief, it is extremely unlikely that use of active sonar by submarines would have any effect on marine mammals. Therefore, this type of sonar was not modeled for RIMPAC 2006.
- **Aircraft Sonar Systems.** Aircraft sonar systems that would operate during RIMPAC include sonobuoys and dipping sonar. Sonobuoys may be deployed by P-3 aircraft or helicopters; dipping sonars are used by carrier-based helicopters. A sonobuoy is an expendable device used by aircraft for the detection of underwater acoustic energy and for conducting vertical water column temperature measurements. Most sonobuoys are passive, but some can generate active acoustic signals, as well as listen passively. Dipping sonar is an active or passive sonar device lowered on cable by helicopters to detect or maintain contact with underwater targets. During RIMPAC, these systems active modes are only used briefly for localization of contacts and are not used in primary search capacity. Because active mode dipping sonar use is very brief (2-5 pulses of 3.5-700 msec), it is extremely unlikely its use would have any effect on marine mammals. The AN/AQS 13 (dipping sonar) used by carrier based helicopters was determined in the *Environmental Assessment/Overseas Environmental Assessment of the SH-60R Helicopter/ALFS Test Program*, October 1999 (Section 3.6.3), not to be problematic due to its limited use and very short pulse length. Since 1999, during the time of the test plan, there have been over 500 hours of operation, with no environmental effects observed. Therefore, the aircraft sonar systems were not modeled for RIMPAC 2006.
- **Torpedoes.** Torpedoes are the primary ASW weapon used by surface ships, aircraft, and submarines. The guidance systems of these weapons can be autonomous or electronically controlled from the launching platform through an attached wire. The autonomous guidance systems are acoustically based. They operate either passively, exploiting the emitted sound energy by the target, or actively, ensonifying the target and using the received echoes for guidance. All torpedoes used for ASW during RIMPAC would be located in the range area managed by PMRF and would be non-explosive and recovered after use. Potential impacts from the use of torpedoes on the PMRF range areas were analyzed in the PMRF EIS and, consistent with the National Oceanic and Atmospheric Administration's (NOAA's) June 3, 2002, Endangered Species Act Section 7 letter to the Navy for RIMPAC 2002, the Navy determined that the activities are not likely to adversely affect listed species under the jurisdiction of the National Marine Fisheries Service (NMFS).
- **Acoustic Device Countermeasures (ADC).** ADCs are, in effect, submarine simulators that make noise to act as decoys to avert localization and/or torpedo

attacks. Previous classified analysis has shown that, based on the operational characteristics (source output level and/or frequency) of these acoustic sources, the potential to affect marine mammals was unlikely, and therefore they were not modeled for RIMPAC 2006.

- **Training Targets.** ASW training targets are used to simulate target submarines. They are equipped with one or a combination of the following devices: (1) acoustic projectors emanating sounds to simulate submarine acoustic signatures; (2) echo repeaters to simulate the characteristics of the echo of a particular sonar signal reflected from a specific type of submarine; and (3) magnetic sources to trigger magnetic detectors. Based on the operational characteristics (source output level and/or frequency) of these acoustic sources, the potential to affect marine mammals is unlikely, and therefore they were not modeled for RIMPAC 2006. Consistent with NOAA's June 3, 2002, Endangered Species Act Section 7 letter to the Navy for RIMPAC 2002, the Navy determined that the activities are not likely to adversely affect listed species under the jurisdiction of the NMFS.
- **Range Sources.** Range pingers are active acoustic devices that allow each of the in-water platforms on the range (e.g., ships, submarines, target simulators, and exercise torpedoes) to be tracked by hydrophones in the range transducer nodes. In addition to passively tracking the pinger signal from each range participant, the range transducer nodes also are capable of transmitting acoustic signals for a limited set of functions. These functions include submarine warning signals, acoustic commands to submarine target simulators (acoustic command link), and occasional voice or data communications (received by participating ships and submarines on range). Based on the operational characteristics (source output level and/or frequency) of these acoustic sources, the potential to affect marine mammals is unlikely, and therefore they were not modeled for RIMPAC 2006. Consistent with NOAA's June 3, 2002, Endangered Species Act Section 7 letter to the Navy for RIMPAC 2002, the Navy determined that the activities are not likely to adversely affect listed species under the jurisdiction of the NMFS.

2.2 ALTERNATIVE 2—PROPOSED ACTION LIMITED TO PREVIOUSLY ANALYZED LOCATIONS AND ACTIVITIES

Alternative 2 consists of the set of proposed RIMPAC training events that were identified at the RIMPAC Initial Planning Conference in August 2005, confirmed at the Mid Planning Conference in November 2005, and verified after the Final Planning Conference in March 2006, with the exception of the Non-Combatant Evacuation Operation (NEO) at Pacific Missile Range Facility (PMRF) and Niihau. RIMPAC 2006 training events would occur within the locations included in the RIMPAC PEA and 2004 Supplement, which are listed in Table 2-1.

For this alternative, the potential environmental effects of all of the training events proposed for RIMPAC 2006 were analyzed in the RIMPAC PEA and the 2004 Supplement. As described for the Proposed Action in Section 2.1, prior to each subsequent RIMPAC, the proposed actions will be compared to the analysis in the RIMPAC PEA. Because the training events described in the Proposed Action are the same as those for this alternative, with the exception of changed event locations, the review of RIMPAC 2006 activities compared to the RIMPAC PEA and the 2004 Supplement (Sections 2.1.1.2 and 2.1.1.3) and the description of the Antisubmarine Warfare (ASW) operations, and the ASW acoustic effects modeling completed for RIMPAC 2006 (Section 2.1.2) are incorporated into this alternative.

2.3 ALTERNATIVE 3—NO ACTION

Under the No-action Alternative, the RIMPAC Exercise would not be conducted. The existing training events would not be combined into a multinational, sea control/power projection fleet training exercise in a multi-threat environment. Multinational force command, control, and communication training for operating in simulated hostile scenarios would not occur. There would be no enhanced communication and cooperation between nations, and the United States would not be able to ensure that it can accomplish shared operational objectives with other Pacific Rim nations. Operational forces would not be able to engage in multinational battle-realistic training including, aircraft operations, ship maneuvers, amphibious landings, troop movements, gunfire and missile exercises, submarine and antisubmarine warfare training events, mining and demolition activities, salvage, special warfare operations, and humanitarian operations. This situation would be counter to the readiness mandate identified in U.S. Code Title 10.

Individual exercises would continue to be routinely conducted by U.S. forces in the open ocean, nearshore, and onshore environments in established and recognized training areas.

2.4 OTHER ALTERNATIVES

There are no other reasonable alternatives that would meet the purpose and need of the Proposed Action as described in the RIMPAC PEA, 2004 Supplement, and this 2006 Supplement; therefore, no further discussion is necessary.

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3.0 AFFECTED ENVIRONMENT

As described in Section 2.1, there are no new locations for RIMPAC 2006 beyond those evaluated in the RIMPAC PEA and the 2004 Supplement. Table 3-1 shows the resource areas evaluated at each location in the RIMPAC PEA and the 2004 Supplement. The affected environment described in those documents is still applicable. A NEO is proposed at PMRF and Niihau, at locations that have been analyzed for other activities in previous RIMPAC Exercises. The affected environment at PMRF and Niihau was reviewed in the area that would support a NEO, and the only potentially affected resource areas would be biological resources at PMRF and biological and cultural resources at Niihau.

Table 3-1 Resource Areas Evaluated in the RIMPAC PEA and the 2004 Supplement

Affected Environment	Resource Area										
	Air Quality	Airspace	Biological Resources	Cultural Resources	Geology & Soils	Hazardous Materials and Waste	Land Use	Noise*	Safety and Health	Socioeconomics	Water Resources
Pacific Missile Range Facility, Kauai (Port Allen, Makaha Ridge)	x	x	**X**	x	x	x	x	x	x		x
Niihau			**X**	**X**							
Kaula		x	x	x					x		x
Pearl Harbor, Oahu (Ford Island and other areas within the harbor)		x	x							x	
Iroquois Land/Underwater Range, Oahu			x								
Puuloa Underwater Range, Oahu			x				x		x		
Barbers Point Underwater Range, Oahu			x				x		x		
Coast Guard Air Station Barbers Point/ Kalaeloa Airport, Oahu		x	x								
Marine Corps Base Hawaii, Oahu		x	x	x				x			
Hickam Air Force Base, Oahu		x	x	x							
Marine Corps Training Area Bellows, Oahu		x	x	x			x	x			
Kahuku Training Area, Oahu		x	x	x							
Makua Military Reservation, Oahu		x	x	x				x	x		
Dillingham Military Reservation, Oahu		x	x	x							
Wheeler Army Airfield, Oahu			x								
K-Pier, Kawaihae, Hawaii			x				x				
Bradshaw Army Airfield, Hawaii		x	x	x							
Pohakuloa Training Area, Hawaii		x	x	x				x	x		x
Ocean Areas		x	**X**						x		x
Keehi Lagoon, Oahu			x							x	

Note: x – analyzed in RIMPAC PEA and the 2004 Supplement; **X** – analyzed in this 2006 Supplement
* Noise resource is for human receptors

The areas proposed for ASW operations during RIMPAC have been used during previous RIMPAC Exercises. However, new scientific information has led to the ability to quantitatively assess potential effects to marine mammals through the use of newly derived threshold criteria. As a result of those changes, the affected environment will be described in more detail with respect to marine mammals and endangered species.

3.1 PMRF AND NIIHAU

The proposed area for the NEO at PMRF would include the beach at Majors Bay, located south of the Main Base and about 1,000 feet north of the PMRF housing area. The beach is used for large-scale amphibious training by Amphibious Task Force and Marine Expeditionary Unit elements. Figure 3-1 shows the location of the RIMPAC NEO areas at Majors Bay in relationship to other facilities on base.

3.1.1 PMRF Biological Resources

The broad, white, sandy beach fronting Majors Bay supports only sparse littoral vegetation composed of kiawe-koa haole thickets on the northern half, some long thorn kiawe along the beach front, and patches of agave. Patches of native *Dodonaea-Vitex* scrub exist on the southern half. The nearest proposed or designated critical habitat, unoccupied, for *Panicum niihauensis* is located approximately 850 feet northwest and 3,600 feet southeast of the proposed NEO location.

Migratory shorebirds and seabirds that frequent the beach are among 39 bird species that have been observed throughout PMRF. No threatened or endangered terrestrial species have been recorded within the amphibious landing site. (U.S. Army Garrison, Hawaii, and U.S. Army Corps of Engineers, 1997)

Threatened green sea turtles (*Chelonia mydas*) infrequently nest on the beach at PMRF. One turtle nest was discovered on the southern portion of PMRF in 1985 (Pacific Missile Range Facility, Barking Sands, 1998). During a 1990 survey of the shoreline of PMRF, approximately 32 green sea turtles, a federal threatened and state endangered species, were observed. In 1999, two nests and four indications of further nesting activities were observed in the Nohili ditch area, approximately 3.5 miles north of the proposed NEO area. There is no indication of any nesting activity in recent years. Although green sea turtles may haul out at various points along the PMRF beach, they frequently haul out at the Nohili Ditch outfall when it is flowing, and feed on attached growths adjacent to the outfall (Burger, Personal Communication, 2005).

The endangered Hawaiian monk seal (*Monachus schauinslandi*) occasionally occurs in the waters fronting the Majors Bay beach landing area. Monk seals have been observed to haul out on PMRF beaches. A Hawaiian monk seal birth occurred on PMRF approximately 1 mile north of the NEO site in 1999 (Pacific Missile Range Facility, 1999).

Explanation

- Roads
- RIMPAC NEO Staging Area
- RIMPAC NEO Training Beach Area
- PMRF Installation Boundary
- Critical Habitat - Panicum niihauense

North

0 3,000 6,000 12,000 Feet

RIMPAC NEO Areas Pacific Missile Range Facility

Kauai, Hawaii

Figure 3-1

3.1.2 Niihau Biological Resources

On Niihau the NEO activities would utilize existing openings, trails, and roads and the Navy's mobile operations area. The vegetation of the island is dominated by non-native plant species and plant communities. The United States Fish and Wildlife Service (USFWS) has proposed designating critical habitat for three plant species on Niihau. Monk seals are reported to haul out on areas of Niihau. Locations selected for RIMPAC activities were chosen to avoid potential haul out areas.

3.1.3 Niihau Cultural Resources

The island of Niihau is private property. According to a reconnaissance survey conducted in May 1987 by Dr. William Kikuchi of the Kauai Community College, there are no signs of permanent habitation and few cultural resource sites. Locations selected for RIMPAC activities were chosen to avoid sites with known cultural features.

3.2 OCEAN AREA HAWAIIAN ISLANDS

Ongoing RIMPAC activities in the open-ocean area were analyzed in the RIMPAC PEA (Section 4.1.19, pg 4-28) (Appendix E, 5) and the 2004 Supplement (Section 4.1.19, pg 4-5) (Appendix E, 6). Those outside jurisdictional waters of the United States were analyzed per EO 12114. As described in Section 1.2, long-term studies of the quantification and effects of exposure of marine mammal species to acoustic emissions are progressing and the Navy, in coordination with the NMFS, is incorporating the results into relevant environmental planning analyses and documents. The region of influence for RIMPAC 2006 analysis includes the Hawaiian Islands Operating Area shown on Figure 2-1. This section includes additional information on marine mammals within these areas.

3.2.1 Marine Mammals

The information contained in this section relies heavily on the data gathered in the Marine Resource Assessment (MRA) for the Hawaiian Islands Operating Area (DoN 2005a). Based on the MRA, there are 27 marine mammal species with possible or confirmed occurrence in the Hawaiian Islands Operating Area. As shown in Table 3-2, there are 25 cetacean species (whales, dolphins, and porpoises) and 2 pinnipeds (seals). In addition, five species of sea turtles are known to occur in the Hawaiian Islands Operating Area.

3.2.2 Marine Mammal Occurrence

The MRA data were used to provide a regional context for each species. The data were compiled from available sighting records, literature, satellite tracking, and stranding and bycatch data. The most abundant marine mammals are rough-toothed dolphins, dwarf sperm whales, and Fraser's dolphins and the most abundant large whales are sperm whales (Barlow 2003). There are three seasonally migrating baleen whale species that winter in Hawaiian waters including minke, fin, and humpback whales. Humpback whales utilize Hawaiian

Table 3-2 Marine Mammals that May Occur in the Hawaiian Islands Operating Area

Order Cetacea	Scientific Name	Status	Occurs[1]	Group Size[2]	Detection Probability[3] Group 1-20	Group >20	Overall Abundance
Suborder Mysticeti (baleen whales)							
Family Balaenidae (right whales)							
North Pacific right whale	*Eubalaena japonica*	E	Rare				
Family Balaenopteridae (rorquals)							
Humpback whale[4]	*Megaptera novaeangliae*	E	Regular				
Minke whale	*Balaenoptera acutorostrata*		Rare				
Sei whale	*Balaenoptera borealis*	E	Rare	3.4	0.90	0.90	77
Fin whale	*Balaenoptera physalus*	E	Rare	2.6	0.90	0.90	174
Blue whale	*Balaenoptera musculus*	E	Rare				
Bryde's whale	*Balaenoptera edini/brydei**		Regular	1.5	0.90	0.90	493
Suborder Odontoceti (toothed whales)							
Family Physeteridae (sperm whale)							
Sperm whale	*Physeter macrocephalus*	E	Regular	7.8	0.87	0.87	7,082
Family Kogiidae (pygmy sperm whales)							
Pygmy sperm whale	*Kogia breviceps*		Regular	1.0	0.35	0.35	7,251
Dwarf sperm whale	*Kogia sima*		Regular	2.3	0.35	0.35	19,172
Family Ziphiidae (beaked whales)							
Cuvier's beaked whale	*Ziphius cavirostris*		Regular	2.0	0.23	0.23	12,728
Blainville's beaked whale	*Mesoplodon densirostris*		Regular	2.3	0.45	0.45	2,138
Longman's beaked whale	*Indopacetus pacificus*		Regular	17.8	0.96	0.96	766
Family Delphinidae (dolphins)							
Rough-toothed dolphin	*Steno bredanensis*		Regular	14.8	0.74	1.00	19,904
Common bottlenose dolphin	*Tursiops truncatus*		Regular	9.5	0.74	1.00	3,263
Pantropical spotted dolphin	*Stenella attenuata*		Regular	60.0	0.77	1.00	10,260
Spinner dolphin	*Stenella longirostris*		Regular	29.5	0.77	1.00	2,804
Striped dolphin	*Stenella coeruleoalba*		Regular	37.3	0.77	1.00	10,385
Risso's dolphin	*Grampus griseus*		Regular	15.4	0.74	1.00	2,351
Melon-headed whale	*Peponocephala electra*		Regular	89.2	0.74	1.00	2,947
Fraser's dolphin	*Lagenodelphis hosei*		Rare	286.3	0.77	1.00	16,836
Pygmy killer whale	*Feresa attenuata*		Regular	14.4	0.74	1.00	817
False killer whale	*Pseudorca crassidens*		Regular	10.3	0.74	1.00	268
Killer whale	*Orcinus orca*		Regular	6.5	0.90	0.90	430
Short-finned pilot whale	*Globicephala macrorhynchus*		Regular	22.3	0.74	1.00	8,846
Order Carnivora							
Suborder Pinnipedia (seals, sea lions, walruses)							
Family Phocidae (true seals)							
Hawaiian monk seal	*Monachus scauinslandi*	E	Regular				
Northern elephant seal	*Mirounga angustirostris*		Rare				

Source: DoN 2005a, Barlow 2003
Notes:
Taxonomy follows Rice (1998) for pinnipeds and sirenians and IWC (2004) for cetaceans.
[1] Occurrence: **Regular** = A species that occurs as a regular or normal part of the fauna of the area, regardless of how abundant or common it is; **Rare** = A species that only occurs in the area sporadically; *includes more than one species, but nomenclature is still unsettled.
[2] Mean group sizes are the geometric mean of best estimates from multiple observers and have not been corrected for bias.
[3] Barlow (2003)
[4] Humpback whale is included in the table although it is not expected to be present during the RIMPAC timeframe.

waters as a major breeding ground during winter and spring (November through April). Humpback whales should not be present during the RIMPAC Exercise, which takes place in July. Because definitive information on the other two migrating species is lacking, their presence during the July timeframe was assumed although it is unlikely.

Each marine mammal species is described below with available distribution information related to the summer months when RIMPAC would occur. Although the humpback whale is not believed to be present in Hawaii during the July timeframe, it is included in the text below for completeness.

Seven marine mammal species listed as federal endangered occur in the area, including the humpback whale, North Pacific right whale, sei whale, fin whale, blue whale, sperm whale, and Hawaiian monk seal. Endangered marine mammals are presented first in the following text, with the remaining species following the order presented in Table 3-2.

3.2.2.1 Endangered Cetaceans

Humpback Whale (*Megaptera novaeangliae*)

Humpback whales in Hawaiian waters are considered to be from the central North Pacific stock (Angliss and Lodge 2004). There are an estimated 4,005 (Coefficient of Variation [CV]=0.095) individuals in this stock (Angliss and Lodge 2004). Estimates from Calambokidis *et al.* (1997) and Baker and Herman (1987) suggest that the stock has increased in abundance.

Humpback whales utilize Hawaiian waters as a major breeding ground during winter and spring (November through April). Humpback whales are not expected to be present during the RIMPAC Exercise, which takes place in mid-summer, typically late June through July. Peak abundance around the Hawaiian Islands is from late February through early April (Mobley *et al.* 2001a; Carretta *et al.* 2005). During the fall-winter period, primary occurrence is expected from the coast to 50 nautical miles (nmi) (93 kilometers [km]) offshore, which takes into consideration both the available sighting data and the preferred breeding habitat (shallow waters) (Herman and Antinoja 1977; Mobley *et al.* 1999, 2000, 2001a). The greatest densities of humpback whales (including calves) are in the four-island region consisting of Maui, Molokai, Kahoolawe, and Lanai, as well as Penguin Bank (Baker and Herman 1981; Mobley *et al.* 1999; Maldini 2003). Secondary occurrence is expected from seaward of this area, past the Hawaiian Islands Operating Area boundaries.

North Pacific Right Whale (*Eubalaena japonica*)

No reliable population estimate presently exists for this species; the population in the eastern North Pacific is considered to be very small, perhaps only in the tens of animals (NMFS 2002; Clapham *et al.* 2004), while in the western North Pacific, the population may number at least in the low hundreds (Brownell *et al.* 2001; Clapham *et al.* 2004). There is no proposed or designated critical habitat for the North Pacific right whale in the Hawaiian Islands Operating Area. NMFS has recently proposed two areas within the Gulf of Alaska and the Bering Sea as critical habitat for the North Pacific right whale.

Right whales occur in sub-polar to temperate waters. The North Pacific right whale historically occurred across the Pacific Ocean north of 35 degrees north, with concentrations in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and the Sea of Japan (Omura *et al.* 1969; Scarff 1986; Clapham *et al.* 2004). Presently, sightings are extremely rare, occurring primarily in the Okhotsk Sea and the eastern Bering Sea (Brownell *et al.* 2001; Shelden *et al.* 2005). Prior to 1996, right whale sightings were very rare in the eastern North Pacific (Scarff 1986; Brownell *et al.* 2001). Recent summer sightings of right whales in the eastern Bering Sea represent the first reliable consistent observations in this area since the 1960s (Tynan *et al.* 2001; LeDuc 2001).

Historical whaling records provide virtually the only information on North Pacific right whale distribution. During the summer, whales were found in the Gulf of Alaska, along both coasts of the Kamchatka Peninsula, the southeastern Bering Sea, and in the Okhotsk Sea (Clapham *et al.* 2004; Shelden *et al.* 2005). Based on migration patterns and whaling data, the Hawaiian Islands may have been a breeding ground for North Pacific right whales in the past (Clapham *et al.* 2004). Therefore, occurrence patterns would likely change in this area if the population were to increase substantially.

There are very few recorded sightings from the Hawaiian Islands; they are from both shallow and deep waters (Herman *et al.* 1980; Rowntree *et al.* 1980; Salden and Mickelsen 1999). The highly endangered status of this species necessitates an extremely conservative determination of its occurrence (Jefferson personal communication, 2005). Secondary occurrence is expected from the coastline to seaward of the Hawaiian Islands Operating Area boundaries. Right whales are not expected to make their way into lagoons or busy harbors (Jefferson personal communication, 2005). Right whale occurrence patterns are assumed to be similar throughout the year.

Fin Whale (*Balaenoptera physalus*)

The NOAA stock assessment report recognizes three stocks of fin whales in the North Pacific: (1) the Hawaii stock; (2) the California/Oregon/Washington stock; and (3) the Alaska stock (Carretta *et al.* 2005). The best available estimate of abundance for the Hawaiian stock of the fin whale is 174 individuals (CV = 0.72) (Barlow 2003; Carretta *et al.* 2005).

Fin whales are not common in the Hawaiian Islands. Sightings were reported north of Oahu in May 1976, the Kauai Channel in February 1979, and north of Kauai during February 1994 (Shallenberger 1981; Mobley *et al.* 1996). Thompson and Friedl (1982) suggested that fin whales migrate into Hawaiian waters mainly during fall and winter, based on acoustic recordings off the islands of Oahu and Midway (Northrop *et al.* 1971; McDonald and Fox 1999). Primary occurrence is expected seaward of the 100 meter (m) isobath during the fall-winter period to account for possible stragglers migrating through the area. There is a rare occurrence of fin whales throughout the Hawaiian Islands during the spring-summer period.

Sei Whale (*Balaenoptera borealis*)

For the NOAA stock assessment reports, sei whales within the Pacific Exclusive Economic Zone (EEZ) are divided into three discrete, non-contiguous areas: (1) the Hawaiian stock; (2) California/Oregon/Washington stock; and (3) the Eastern North Pacific (Alaska) stock

(Carretta *et al.* 2005). The best available estimate of abundance is 77 sei whales (CV = 1.06) for the Hawaiian Islands EEZ (Barlow 2003; Carretta *et al.* 2005).

The taxonomy of the baleen whale group formerly known as sei and Bryde's whales is currently confused and highly controversial (see Reeves *et al.* 2004 for a recent review, also see the Bryde's whale species account below for further explanation).

Sei whales spend the summer months feeding in the subpolar higher latitudes and return to the lower latitudes to calve in winter.

The sei whale is considered to be rare in Hawaiian waters based on reported sighting data and the species' preference for cool, temperate waters. Secondary occurrence is expected seaward of the 3,000 m isobath on the north side of the islands only. This pattern was based on sightings made during the NMFS–Southwest Fisheries Science Center shipboard survey assessment of Hawaiian cetaceans (see Barlow *et al.* 2004). Sei whales are expected to be rare throughout the remainder of the Hawaiian Islands Operating Area. Occurrence patterns are expected to be the same throughout the year.

Blue Whale (*Balaenoptera musculus*)

Acoustic data suggests that there are two stocks: the western North Pacific stock (that includes Hawaii) and the eastern north Pacific stock (Stafford *et al.* 2001; Stafford 2003). No estimate of abundance is available for the western North Pacific stock of the blue whale (Carretta *et al.* 2005).

Blue whales are distributed from the ice edges to the tropics in both hemispheres (Jefferson *et al.* 1993). Blue whales as a species are thought to summer in high latitudes and move into the subtropics and tropics during the winter (Yochem and Leatherwood 1985). Data from both the Pacific and Indian Oceans, however, indicate that some individuals may remain in low latitudes year-round, such as over the Costa Rican Dome (Wade and Friedrichsen 1979; Reilly and Thayer 1990).

Blue whales belonging to the western North Pacific stock appear to feed during summer southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska (Stafford, 2003; Watkins *et al.* 2000), and in winter they migrate to lower latitudes in the western Pacific and less frequently in the central Pacific, including Hawaii (Stafford *et al.* 2001; Carretta *et al.* 2005).

The only (presumably) reliable sighting report of this species in the central North Pacific was a sighting made from a scientific research vessel about 400 km northeast of Hawaii in January 1964 (NMFS 1998).

There is a rare occurrence for the blue whale throughout the year throughout the entire Hawaiian Islands Operating Area. Blue whale calls have been recorded off Midway and Oahu (Northrop *et al.* 1971; Thompson and Friedl 1982; McDonald and Fox 1999); these provide evidence of blue whales occurring within several hundred kilometers of these islands (NMFS 1998). The recordings made off Oahu showed bimodal peaks throughout the year, suggesting that the animals were migrating into the area during summer and winter

(Thompson and Friedl 1982; McDonald and Fox 1999). The greatest likelihood of encountering blue whales would be in waters greater than 100 m, based on observations in locales that blue whales are seen regularly (e.g., Schoenherr 1991).

Sperm Whale (*Physeter macrocephalus*)

The NOAA stock assessment report divides sperm whales within the U.S. Pacific EEZ into three discrete, noncontiguous areas: (1) waters around the Hawaiian Islands, (2) California, Oregon, and Washington waters, and (3) Alaskan waters (Carretta *et al.* 2005). The best available abundance estimate for the Hawaiian Islands stock of the sperm whale is 7,082 individuals (CV = 0.30) (Barlow 2003; Carretta *et al.* 2005). Sperm whale abundance in the eastern temperate North Pacific is estimated to be 32,100 individuals and 26,300 individuals by acoustic and visual detection methods, respectively (Barlow and Taylor 2005).

Sperm whales are widely distributed throughout the Hawaiian Islands year-round (Rice 1960; Shallenberger 1981; Lee 1993; and Mobley *et al.* 2000). Sperm whale clicks recorded from hydrophones off Oahu confirm the presence of sperm whales near the Hawaiian Islands throughout the year (Thompson and Friedl 1982). The primary area of occurrence for the sperm whale is seaward of the shelf break in the Hawaiian Islands Hawaiian Islands Operating Area. There is a rare occurrence of sperm whales from the shore to the shelf break. This occurrence prediction is based on the possibility of this typically deepwater species being found in insular shelf waters that are in such close proximity to deep water. Occurrence patterns are assumed to be similar throughout the year.

3.2.2.2 Endangered Pinniped

Hawaiian Monk Seal (*Monachus scauinslandi*)

Hawaiian monk seals are managed as a single stock although there are six main reproductive subpopulations at French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Island, and Kure Atoll (Ragen and Lavigne 1999; Carretta *et al.* 2005). Genetic comparisons between the Northwestern and Main Hawaiian Island seals have not yet been conducted, but observed interchange of individuals among the regions is extremely rare, suggesting that these may be more appropriately designated as separate stocks; further research is needed (Carretta *et al.* 2005).

The best estimate of the total population size is 1,304 individuals (Carretta *et al.* 2005). There are an estimated 55 seals in the Main Hawaiian Islands (Baker and Johanos 2004; DoN 2005a; Carretta *et al.* 2005). The vast majority of the population is present in the Northwestern Hawaiian Islands. The trend in abundance for the population over the past 20 years has mostly been negative (Baker and Johanos 2004; Carretta *et al.* 2005). A self-sustaining subpopulation in the Main Hawaiian Islands may improve the monk seal's long-term prospects for recovery (MMC 2003; Baker and Johanos 2004; Carretta *et al.* 2005).

Critical habitat for the Hawaiian monk seal is designated from the shore out to 37 m (20 fathoms) in 10 areas of the Northwestern Hawaiian Islands (NMFS 1988).

Most monk seal haulout events in the Main Hawaiian Islands have been on the western islands of Niihau and Kauai (Baker and Johanos 2004; Carretta *et al.* 2005), although sightings or births have now been reported for all of the Main Hawaiian Islands, including Lehua Rock and Kaula Rock (MMC 2003; Baker and Johanos 2004).

Hawaiian monk seals show very high site fidelity to natal islands, with only about 10% of individuals moving to another island in their lifetime (Gilmartin and Forcada 2002). While monk seals do move between islands, long-distance movements are not common. Seals move distances of up to 250 km on a regular basis, but distances of more than 1,000 km have not been documented (DeLong *et al.* 1984; Ragen and Lavigne 1999).

Primary occurrence of monk seals is expected in a continuous band between Nihoa, Kaula Rock, Niihau, and Kauai. This band extends from the shore to around the 500 m isobath and is based on the large number of sightings and births recorded in this area (Westlake and Gilmartin 1990; Ragen and Finn 1996; MMC 2003; Baker and Johanos 2004). An area of secondary occurrence is expected from the 500 m isobath to the 1,000 m isobath around Nihoa, Kaula Rock, Niihau, and Kauai. A continuous area of secondary occurrence is also expected from the shore to the 1,000 m isobath around the other Main Hawaiian Islands, taking into account sighting records, the location of deepsea corals, and the ability of monk seals to forage in water deeper than 500 m (Parrish *et al.* 2002; Severns and Fiene Severns 2002; Kona Blue Water Farms 2003; Kubota 2004; Anonymous 2005; Fujimori 2005; Parrish personal communication, 2005). The Pearl Harbor entrance is included in the area of secondary occurrence based on sightings of this species near the entrance of the harbor (DoN 2001b). There is a rare occurrence of the monk seal seaward of the 1,000 m isobath. Occurrence patterns are expected to be the same throughout the year.

An underwater audiogram obtained for the Hawaiian monk seal showed relatively poor hearing sensitivity, as well as a narrow range of best sensitivity and a relatively low upper frequency limit (Thomas *et al.* 1990). The data demonstrated best underwater hearing at 12 to 28 kHz and 60 to 70 kHz (Thomas *et al.* 1990). It should be noted that this audiogram is based on a single animal whose hearing curve has some characteristics that suggest its responses may have been affected by disease or age (Reeves *et al.* 2001).

3.2.2.3 Non-Endangered Cetaceans

Minke Whale (*Balaenoptera acutorostrata*)

For the NOAA stock assessment report, there are three stocks of minke whales within the U.S. Pacific EEZ: (1) a Hawaiian stock; (2) a California/Oregon/Washington stock; and (3) an Alaskan stock (Carretta *et al.* 2005). There currently is no abundance estimate for the Hawaiian stock of minke whales, which appears to occur seasonally (approximately November through March) around the Hawaiian Islands (Carretta *et al.* 2005).

The minke whale is expected to occur seasonally in the Hawaiian Islands Operating Area (Barlow 2003). Abundance is expected to be higher between November and March (Carretta *et al.* 2005). Therefore, an area of secondary occurrence is seaward of the shoreline during the fall-winter period. Both visual and acoustic detections of minke whales have been reported for this area (e.g., Balcomb 1987; Thompson and Friedl 1982; Barlow *et al.* 2004;

Carretta *et al.* 2005; Norris *et al.* 2005). The occurrence pattern takes into account both sightings in shallow waters in some locales globally as well as the anticipated oceanic occurrence of this species (Jefferson personal communication, 2005). “Boings” were recorded in waters with a bottom depth of approximately 1,280 m to 3,840 m (Norris *et al.* 2005). Norris *et al.* (2005) reported sighting a minke whale 93 km southwest of Kauai, in waters with a bottom depth of approximately 2,560 m. During the spring-summer period, there is a rare occurrence for the minke whale throughout the entire Hawaiian Islands Operating Area.

Bryde’s Whale (*Balaenoptera edenybrydei*)

For the NOAA stock assessment reports, Bryde’s whales within the U.S. Pacific EEZ are divided into two areas: (1) Hawaiian waters, and (2) the eastern tropical Pacific (east of 150°W and including the Gulf of California and waters off California) (Carretta *et al.* 2005). The abundance estimate for the Hawaiian Islands stock of the Bryde’s whale is 493 individuals (CV = 0.34) (Barlow 2003).

Bryde’s whales are seen year-round throughout tropical and subtropical waters (Kato 2002) and are also expected in the Hawaiian Islands Operating Area year-round (Jefferson personal communication, 2005). It should be noted that more sightings are reported for the Northwest Hawaiian Islands than in the Main Hawaiian Islands (e.g., Barlow *et al.* 2004; Carretta *et al.* 2005). Bryde’s whales have been reported to occur in both deep and shallow waters globally. There is a secondary occurrence of Bryde’s whales seaward of the 50 m isobath in the Hawaiian Islands Operating Area. Bryde’s whales are sometimes seen very close to shore and even inside enclosed bays (see Best *et al.* 1984).

Pygmy and Dwarf Sperm Whales *(Kogia breviceps* and *Kogia sima*, respectively)

Pygmy and dwarf sperm whales within the U.S. Pacific EEZ are each divided into two discrete, non-contiguous areas: (1) Hawaiian waters, and (2) waters off California, Oregon, and Washington (Carretta *et al.* 2005). The best available estimate of abundance for the Hawaiian stock of the pygmy sperm whale is 7,251 individuals (CV = 0.77) (Barlow 2003; Carretta *et al.* 2005). The best available estimate of abundance for the Hawaiian stock of the dwarf sperm whale is 19,172 individuals (CV = 0.66) (Barlow 2003; Carretta *et al.* 2005).

Both species of *Kogia* generally occur in waters along the continental shelf break and over the continental slope (e.g., Baumgartner *et al.* 2001; McAlpine 2002; Baird 2005a). The primary occurrence for *Kogia* is seaward of the shelf break in the Hawaiian Islands Operating Area. This takes into account their preference for deep waters. There is a rare occurrence for *Kogia* inshore of the area of primary occurrence. Occurrence is expected to be the same throughout the year.

Beaked Whales (Family Ziphiidae)

Seven species of beaked whales are known to occur in the North Pacific Ocean (MacLeod *et al.* in press); only three are expected to occur in the Hawaiian Islands Operating Area: Cuvier’s beaked whale, Blainville’s beaked whale (*Mesoplodon densirostris*), and

Longman's beaked whale. Of these species, only the Cuvier's beaked whale is relatively easy to identify.

The best available estimate of abundance for the Hawaiian stock of the Cuvier's beaked whale is 12,728 individuals (CV = 0.83) (Barlow 2003; Carretta *et al.* 2005). The best available estimate of abundance for the Hawaiian stock of the Blainville's beaked whale is 2,138 individuals (CV = 0.77) (Barlow 2003; Carretta *et al.* 2005). The best available estimate of abundance for the Hawaiian stock of the Longman's beaked whale is 766 individuals (CV = 1.05) (Barlow 2003; Carretta *et al.* 2005).

Cuvier's beaked whales are generally sighted in waters with a bottom depth greater than 200 m and are frequently recorded at depths of 1,000 m or more (Gannier 2000; MacLeod *et al.* 2004). They are commonly sighted around seamounts, escarpments, and canyons. In the eastern tropical Pacific, the mean bottom depth for Cuvier's beaked whales is approximately 3,400 m, with a maximum depth of over 5,100 m (Ferguson 2005). Both Baird *et al.* (2004) and MacLeod *et al.* (2004) reported that Blainville's beaked whales are found in shallower waters than Cuvier's beaked whales in the Hawaiian Islands and the Bahamas, respectively.

Most of the ecological information for the Blainville's beaked whale comes from the northern Bahamas (MacLeod *et al.* 2004; MacLeod and Zuur 2005).

In the eastern tropical Pacific, the mean bottom depth for Blainville's beaked whale sightings is just over 3,500 m and a maximum depth of 5,750 m (Ferguson 2005).

The Longman's beaked whale appears to have a preference for warm tropical water, with most sightings occurring in waters with a sea surface temperature warmer than 26°C (Pitman *et al.* 1999).

Rough-toothed Dolphin (*Steno bredanensis*)

Nothing is known about stock structure for the rough-toothed dolphin in the North Pacific (Carretta *et al.* 2005). The best available estimate of abundance for the Hawaiian stock of the rough-toothed dolphin is 19,904 individuals (CV = 0.52) (Carretta *et al.* 2005).

In the Main Hawaiian Islands, this species is found in waters with bottom depths ranging from 250 m to 4,320 m, with sighting rates highest in the deepest portions (2,000 to 4,000 m) (Baird personal communication, 2005b).

Rough-toothed dolphins are found in tropical to warm-temperate waters globally, rarely ranging north of 40°N or south of 35° (Miyazaki and Perrin 1994). In the Main Hawaiian Islands, this species appears to demonstrate site fidelity to specific islands (Baird personal communication, 2005b).

Primary occurrence for the rough-toothed dolphin is from the shelf break to seaward of the Hawaiian Islands Operating Area boundaries. There is also an area of rare occurrence of rough-toothed dolphins from the shore to the shelf break.

Common Bottlenose Dolphin (*Tursiops truncatus*)

The best available estimate of abundance for the Hawaiian stock of the bottlenose dolphin is 3,263 individuals (CV = 0.60) (Barlow 2003; Carretta *et al.* 2005).

Bottlenose dolphins found in nearshore waters around the Main Hawaiian Islands are island-associated, with all sightings occurring in relatively nearshore and shallow waters (<200 m), and no apparent movement between the islands (Baird *et al.* 2002, 2003), though Baird *et al.* (2001) noted the possibility that individuals could move between islands. Baird *et al.* (2003) noted the possibility of a second population of bottlenose dolphins in the Hawaiian Islands, based on sighting data, with a preference for deeper (bottom depth of 400 to 900 m) waters.

Bottlenose dolphins are regularly found around the Main Hawaiian Islands in both nearshore and offshore waters (Rice 1960; Shallenberger 1981; Mobley *et al.* 2000; Baird *et al.* 2003). Based on photo-identification studies and sighting data, there is a possibility of separate island populations with different preferences for shallow (<200 m) and deep (400-900 m) waters (Baird *et al.* 2003). Therefore, an area of primary occurrence is expected from the shore to the 1,000 m isobath in the Hawaiian Islands Operating Area, excluding Nihoa due to no survey effort. This area is continuous between Niihau and Kauai and between Oahu, Molokai, Lanai, Maui, and Kahoolawe to account for possible movements between islands. There is a secondary occurrence seaward of the 1,000 m isobath and seaward from the shoreline of Nihoa. Occurrence patterns are expected to be the same throughout the year.

Pantropical Spotted Dolphin (*Stenella attenuata*)

The best available estimate of abundance for the pantropical spotted dolphin within the Hawaiian Islands EEZ is 10,260 individuals (CV = 0.41) (Barlow 2003; Carretta *et al.* 2005).

Based on known habitat preferences and sighting data, the primary occurrence for the pantropical spotted dolphin is between the 100 m and 4,000 m isobaths throughout the Hawaiian Islands Operating Area. This area of primary occurrence also includes a continuous band connecting all the Main Hawaiian Islands, Nihoa, and Kaula Rock, taking into account possible inter-island movements. Secondary occurrence is expected from the shore to the 100 m isobath, as well as seaward of the 4,000 m isobath.

Spinner Dolphin (*Stenella longirostris*)

The best available estimate of abundance for the Hawaiian stock of the spinner dolphin is 2,805 individuals (CV = 0.66) (Barlow 2003; Carretta *et al.* 2005).

Spinner dolphins occur in both oceanic and coastal environments. Most sightings of this species have been associated with inshore waters, islands, or banks (Perrin and Gilpatrick 1994).

Spinner dolphins occur year-round throughout the Hawaiian Islands Operating Area, with primary occurrence from the shore to the 4,000 m isobath. This takes into account nearshore resting habitat and offshore feeding areas. Spinner dolphins are expected to occur in shallow water (50 m or less) resting areas throughout the middle of the day, moving into deep waters offshore during the night to feed. Primary resting areas are along the west side of Hawaii, including Makako Bay, Honokohau Bay, Kailua Bay, Kealakekua Bay, Honaunau Bay, Kauhako Bay, and off Kahena on the southeast side of the island (Östman-Lind *et al.* 2004). Along the Waianae coast of Oahu, spinner dolphins rest along Makua Beach, Kahe Point, and Pokai Bay during the day (Lammers 2004). Kilauea Bay in Kauai is also a popular resting bay for Hawaiian spinner dolphins (Jefferson personal communication, 2005). There is an area of secondary occurrence seaward of the 4,000 m isobath. Although sightings have been recorded around the mouth of Pearl Harbor (Lammers 2004), spinner dolphin occurrence is expected to be rare. Occurrence patterns are assumed to be the same throughout the year. It is currently not known whether individuals move between islands or island groups (Carretta *et al.* 2005).

Striped Dolphin (*Stenella coeruleoalba*)

The best available estimate of abundance for the Hawaiian stock of the striped dolphin is 10,385 individuals (CV = 0.48) (Barlow 2003; Carretta *et al.* 2005).

The striped dolphin regularly occurs throughout the Hawaiian Islands Operating Area. There is a primary occurrence for the striped dolphin is seaward of the 1,000 m isobath based on sighting records and the species' known preference for deep waters. Striped dolphins are occasionally sighted closer to shore (Mobley *et al.* 2000); therefore, an area of secondary occurrence is expected from the 100 m to the 1,000 m isobaths. Occurrence patterns are assumed to be the same throughout the year.

Risso's Dolphin (*Grampus griseus*)

The best available estimate of abundance for the Hawaiian stock of the Risso's dolphin is 2,351 individuals (CV = 0.65) (Barlow 2003; Carretta *et al.* 2005).

There is an area of secondary occurrence between the 100 m and 5,000 m isobaths based on the known habitat preferences of this species, as well as the paucity of sightings even though there is extensive aerial and boat-based survey coverage near the islands. There is a narrow band of rare occurrence from the shore to the 100 m isobath. Risso's dolphins are expected to be rare seaward of the 5,000 m isobath. Occurrence patterns are assumed to be the same throughout the year.

Melon-headed Whale (*Peponocephala electra*)

The best available estimate of abundance for the Hawaiian stock of the melon-headed whale is 2,947 individuals (Barlow 2003; Carretta *et al.* 2005).

Melon-headed whales are most often found in offshore, deep waters. Melon-headed whales in the Main Hawaiian Islands are found in waters with bottom depths ranging from 255 to 4,407 m, with a preference for waters with a bottom depth greater than 2,000 m (Baird personal communication, 2005b; Baird *et al.* 2003). Nearshore sightings are generally from areas where deep, oceanic waters are found near the coast (Perryman 2002).

Preliminary results from photo-identification work in the Main Hawaiian Islands suggest inter-island movements by some individuals (e.g., between the islands of Kauai and Hawaii) as well as some residency by other individuals (e.g., at the island of Hawaii) (Baird personal communication, 2005b).

The melon-headed whale is an oceanic species. Melon-headed whales are primarily expected to occur from the shelf break to seaward of the Hawaiian Islands Operating Area and vicinity. There is rare occurrence from the shore to the shelf break which would take into account any sightings that could occur closer to shore since deep water is very close to shore at these islands. Occurrence patterns are assumed to be the same throughout the year.

Fraser's Dolphin (*Lagenodelphis hosei*)

The best available estimate of abundance for the Hawaiian stock of the Fraser's dolphin is 16,836 individuals (CV = 1.11) (Barlow 2003; Carretta *et al.* 2005).

Fraser's dolphins have only recently been documented in Hawaiian waters (Carretta *et al.* 2005). Sightings have been recorded in the Northwest Hawaiian Islands but not within the Main Hawaiian Islands (Barlow 2003). There is a rare occurrence of the Fraser's dolphin from the shore to seaward of the Hawaiian Islands Operating Area that takes into account that this is an oceanic species that can be found closer to the coast, particularly in locations where the shelf is narrow and deep waters are nearby. Occurrence patterns are assumed to be the same throughout the year.

Pygmy Killer Whale (*Feresa attenuata*)

The best available estimate of abundance for the Hawaiian stock of the pygmy killer whale is 817 individuals (CV = 1.12) (Barlow 2003; Carretta *et al.* 2005).

Pygmy killer whales regularly occur in the Hawaiian Islands Operating Area. Pygmy killer whales are easily confused with false killer whales and melon-headed whales, which are two species that also have expected occurrence in the Hawaiian Islands study area. The pygmy killer whale is primarily expected to occur from the shelf break to seaward of the Hawaiian Islands Operating Area boundaries. There is a rare occurrence from the shore to the shelf break that takes into account any sightings that could occur just inshore of the shelf break, since deep water is very close to shore here. Occurrence patterns are assumed to be the same throughout the year. Pygmy killer whales off the island of Hawaii demonstrate tremendous site fidelity to the island (Baird personal communication, 2005b).

False Killer Whale (*Pseudorca crassidens*)

The best available estimate of abundance for the Hawaiian stock of the false killer whale is 268 individuals (CV = 1.08) (Barlow 2003; Carretta *et al.* 2005). This stock is listed as a strategic stock by NMFS because the estimated level of serious injury and mortality from the Hawaii-based tuna and swordfish longline fishery is greater than the potential biological removal (Carretta *et al.* 2005).

False killer whales are commonly sighted in nearshore waters from small boats and aircraft, as well as offshore from longline fishing vessels (e.g., Mobley *et al.* 2000; Baird *et al.* 2003; Walsh and Kobayashi 2004). Baird *et al.* 2005 reported that false killer whales in the Hawaiian Islands occur in waters from about 40 m to 4,000 m. There is an area of primary occurrence for the false killer whale from the shore to the 2,000 m isobath. There is an additional area of primary occurrence seaward of the 4,000 m isobath on the south side of the islands, which takes into account false killer whale sighting and bycatch data in the southwestern portion of the Hawaiian Islands Operating Area (Forney 2004; Walsh and Kobayashi 2004; Carretta *et al.* 2005). The area of secondary occurrence includes a narrow band between the 2,000 m and 4,000 m isobaths south of the islands and the entire area north of the islands seaward of the 2,000 m isobath. It has been suggested that false killer whales using coastal waters might be a discrete population from those in offshore waters and waters off the Northwest Hawaiian Islands (Baird *et al.* 2005; Carretta *et al.* 2005). The area of secondary occurrence takes into account the possibility of two different stocks, with a possible hiatus in their distribution (Jefferson personal communication, 2005). Occurrence patterns are assumed to be the same throughout the year.

Killer Whale (*Orcinus orca*)

The best available estimate of abundance for the Hawaiian stock of the killer whale is 430 individuals (CV = 0.72) (Barlow 2003; Carretta *et al.* 2005).

Killer whales in general are uncommon in most tropical areas (Jefferson personal communication, 2005). The distinctiveness of this species would lead it to be reported more than any other member of the dolphin family, if it occurs in a certain locale. Killer whales are infrequently sighted and found stranded around the Hawaiian Islands (Shallenberger 1981; Tomich 1986; Mobley *et al.* 2001b; Baird *et al.* 2003; Baird *et al.* in preparation), though with increasing numbers of boaters, sightings each year could be expected (Baird personal communication, 2005b). Since the killer whale has a sporadic occurrence in tropical waters and can be found in both coastal areas and the open ocean, there is a rare occurrence of this species in the Hawaiian Islands Operating Area from the shoreline to seaward of the Hawaiian Islands Operating Area boundaries. Occurrence patterns are assumed to be the same throughout the year.

Short-finned Pilot Whale (*Globicephala macrorhynchus*)

The best available estimate of abundance for the Hawaiian stock of the short-finned pilot whale is 8,846 individuals (CV = 0.49) (Barlow 2003; Carretta *et al.* 2005). Stock structure of short-finned pilot whales has not been well-studied in the North Pacific Ocean, except in Japanese waters (Carretta *et al.* 2005). Pilot whales are sighted throughout the Hawaiian Islands (e.g., Shallenberger 1981).

Short-finned pilot whales are expected to occur year-round throughout the Hawaiian Islands Operating Area. They are commonly found in deep waters with steep bottom topography, including deepwater channels between the Main Hawaiian Islands, such as the Alenuihaha Channel between Maui and Hawaii (Balcomb 1987). The area of primary occurrence for this species is between the 200 m and 4,000 m isobaths. Considering the narrow insular shelf and deep waters in close proximity to the shore, secondary occurrence is between the 50 m and

200 m isobaths. Another area of secondary occurrence extends from the 4,000 m isobath to seaward of the Hawaiian Islands Operating Area boundaries. Short-finned pilot whales are expected to be rare between the shore and the 50 m isobath. Occurrence patterns are assumed to be the same throughout the year. Photo-identification work suggests a high degree of site fidelity around the island of Hawaii (Shane and McSweeney 1990).

3.2.2.4 Non-Endangered Pinniped

Northern Elephant Seal (*Mirounga angustirostris*)

The population size has to be estimated since all age classes are not ashore at any one time of the year (Carretta *et al.* 2005). There is a conservative minimum population estimate of 60,547 elephant seals in the California stock (Carretta *et al.* 2005). Based on trends in pup counts, abundance in California is increasing by around 6% annually, but the Mexican stock is evidently decreasing slowly (Stewart *et al.* 1994; Carretta *et al.* 2005).

Northern elephant seals occur in Hawaiian waters only rarely as extralimital vagrants. The most far-ranging individual appeared on Nijima Island off the Pacific coast of Japan in 1989 (Kiyota *et al.* 1992). This demonstrates the great distances that these animals are capable of covering.

There is a rare occurrence of northern elephant seals throughout the Hawaiian Islands Operating Area year-round**.** The first confirmed sighting of a northern elephant seal in the Hawaiian Islands was a female found on Midway Island in 1978 that had been tagged earlier at San Miguel Island (off the coast of southern California) (NWAFC 1978). The first sighting of an elephant seal in the Main Hawaiian Islands occurred on the Kona coast of Hawaii in January 2002; a juvenile male was sighted hauled out at Kawaihae Beach and later at the Kona Village Resort (Fujimori 2002; Antonelis personal communication). Based on these sightings and documented long-distance movements as far west as Japan (NWAFC 1978; Antonelis and Fiscus 1980; Tomich 1986; Kiyota *et al.* 1992; Fujimori 2002), rare encounters with northern elephant seals in the Hawaiian Islands Operating Area are possible.

3.2.3 Threatened and Endangered Sea Turtles

Green Turtle (*Chelonia mydas*)

Although green turtle populations are in serious decline throughout much of the Pacific Ocean, their status is currently improving in Hawaiian waters, presumably due to effective protection at primary nesting areas in the Northwest Hawaiian Islands and better enforcement of regulations prohibiting take of the species. However, the relatively recent increase in fibropapillomatosis, a tumor-producing disease in green turtles that is likely caused by a herpes-type virus, threatens to eliminate improvements in the status of the Hawaiian stock. There are no estimates of the current population size of green turtles in the Pacific Ocean (NMFS and USFWS 1998a, 1998b).

Green turtles occur in the coastal waters surrounding the Main Hawaiian Islands throughout the year and also migrate seasonally to the Northwest Hawaiian Islands in order to reproduce.

Adult green turtles that breed in the Northwest Hawaiian Islands make regular reproductive migrations from their foraging grounds either around the Main Hawaiian Islands or around the westernmost atolls in the Northwest Hawaiian Islands. This has been evidenced by frequent mark-recapture and satellite-tracking studies on both adult male and female green turtles (Balazs 1976, 1983; Balazs and Ellis 2000; Balazs *et al.* 1994). Juvenile green turtles can also make long-range movements throughout the Hawaiian archipelago. From June 2002 to March 2003, a captive-reared green turtle released off northwestern Hawaii traveled over 4,800 km around the Hawaiian Islands, swimming as far west as the waters between Nihoa and Necker Islands before turning around and heading back to the Main Hawaiian Islands (Thompson 2003).

The largest nesting colony in the central Pacific occurs at French Frigate Shoals in the Northwest Hawaiian Islands, where about 200 to 700 females nest each year. On occasion, green turtles also nest in the Main Hawaiian Islands. The most famous nesting green turtle in the Main Hawaiian Islands is turtle 5690, known by sea turtle biologists as "Maui Girl." This turtle, which was raised to a year old at Oahu's Sea Life Park and then tagged and released, has nested on beaches near Lahaina, Maui in 2000, 2002, and 2004 (Leone 2004). Other sporadic nesting events in the Main Hawaiian Islands have occurred along the north shore of Molokai, the northwest shore of Lanai, and the south, northeast, and southwest shores of Kauai (DoN 2001b, 2002; NOS 2001).

Green turtles outnumber all other species combined in the nearshore waters of the Hawaiian archipelago. The available sighting and stranding data for the Hawaiian Islands Operating Area clearly evidence this. The area of year-round primary occurrence for green turtles is located in waters inshore of the 100 m isobath around all of the Main Hawaiian Islands and Nihoa. It is in these areas where reefs, their preferred habitats for foraging and resting, are most abundant. The area of secondary occurrence encompasses an oceanic zone surrounding the Hawaiian Islands. This area is frequently inhabited by adults that are migrating to the Northwest Hawaiian Islands to reproduce and by pelagic stage individuals that have yet to settle into coastal feeding grounds of the Main Hawaiian Islands. Further offshore of this seasonal use zone is the area of year-round rare occurrence, as green turtles are not likely to be found in portions of the Hawaiian Islands Operating Area that are extremely far from land.

Hawksbill Turtle (*Eretmochelys imbricata*)

A lack of regular quantitative surveys for hawksbill turtles in the Pacific Ocean and the discrete nature of this species' nesting have made it extremely difficult for scientists to assess the distribution and population status of hawksbills in the region (NMFS and USFWS 1998c; Seminoff *et al.* 2003). Around the Hawaiian Islands, hawksbills are only known to occur in the coastal waters of the eight main and inhabited islands of the archipelago. Hawksbills forage throughout the Main Hawaiian Islands, although in much fewer numbers than green turtles. Hawksbills have been captured at several locations including Kiholo Bay and Kau (Hawaii), Palaau (Molokai), and Makaha (Oahu) (HDLNR 2002). Strandings have been reported in Kaneohe and Kahana Bays (Oahu) as well as in other locations throughout the Main Hawaiian Islands (Eckert 1993; NMFS and USFWS 1998c). No reliable reports are known from Niihau (DoN 2001b). Hawksbills are much more abundant in the shallow, nearshore waters of the Hawaiian Islands than they are in deeper, offshore waters of the central Pacific Ocean.

Throughout the year, the area of primary occurrence for hawksbill turtles can be found in Hawaiian Islands Operating Area waters shoreward of the 100 m isobath. Beyond the 100 m isobath, hawksbill occurrence is rare year round. Pelagic stage individuals may occur in oceanic waters off the Main Hawaiian Islands and Nihoa, but these life stages are nearly impossible to sight during surveys and rarely, if ever, interact with the pelagic longline fishery. Of the five sea turtle species known to occur in the Hawaiian Islands Operating Area, the hawksbill is the only one that is not taken by Hawaiian longliners (Kobayashi and Polovina 2005).

Olive Ridley Turtle (*Lepidochelys olivacea*)

Until the advent of commercial exploitation, the olive ridley was highly abundant in the eastern tropical Pacific, probably outnumbering all other sea turtle species combined in the area (NMFS and USFWS 1998e). Clifton *et al.* (1995) estimated that a minimum of 10 million olive ridleys were present in ocean waters off the Pacific coast of Mexico prior to 1950. Even though there are no current estimates of worldwide abundance, the olive ridley is still considered the most abundant of the world's sea turtles. However, the number of olive ridley turtles occurring in U.S. territorial waters is believed to be small (NMFS and USFWS 1998e).

Olive ridleys are rare visitors to the nearshore waters around the Hawaiian Islands, although they have been recorded in increasing numbers over the past two decades. Juveniles and adults have become entangled in fishing gear and other marine debris in nearshore waters off Hawaii, Molokai, Maui, and Oahu (Eckert 1993). A total of 26 olive ridley turtles have stranded in the Hawaiian Islands since 1982, making it the third most common species to strand after greens and hawksbills (HDLNR 2002). Available information suggests that olive ridleys traverse through the oceanic waters surrounding the Hawaiian Islands during foraging and developmental migrations (Nitta and Henderson 1993).

In the Hawaiian Islands, a single nesting was recorded along Paia Bay, Maui in September 1985; however, there was no successful hatching associated with this event (Balazs and Hau 1986; NOS 2001). Since there are no other known nesting records for the central Pacific Ocean, the above nesting attempt should be considered an anomaly (NMFS and USFWS 1998e).

About two-thirds of all olive ridleys found in the vicinity of the Hawaiian Islands are derived from eastern Pacific nesting populations, while the remaining one-third originate in the western Pacific or Indian Ocean. As a result, the Hawaiian Islands represent a point of convergence for these source areas (HDLNR 2002).

Based on the oceanic habitat preferences of this species throughout the Pacific Ocean, it has been determined that the area of year-round primary occurrence in the Hawaiian Islands Operating Area lies in waters beyond the 100 m isobath. Olive ridleys are frequently captured by pelagic longline fishermen in deep, offshore waters of the Hawaiian Islands Operating Area, especially during spring and summer. Inside of the 100 m isobath, olive ridley occurrence in the Hawaiian Islands Operating Area is rare year round. Like the loggerhead turtle, there have been few recorded sightings and strandings of this species in the nearshore waters of the Main Hawaiian Islands and Nihoa (as compared to the green and hawksbill turtles, which are primarily nearshore species). A significant number of strandings in an area likely indicates a strong presence in waters nearby, which is not the case here. A single recorded nesting attempt for the olive ridley over the past 20 years also indicates the lack of a need for this species to enter coastal waters surrounding the Hawaiian Islands.

Leatherback Turtle (*Dermochelys coriacea*)

There are few quantitative data available concerning the seasonality, abundance, or distribution of leatherbacks in the central North Pacific Ocean. The leatherback is not typically associated with insular habitats, such as those characterized by coral reefs, yet individuals are occasionally encountered in deep ocean waters near prominent archipelagos such as the Hawaiian Islands (Eckert 1993). Leatherbacks are regularly sighted by fishermen in offshore waters surrounding the Hawaiian Islands, generally beyond the 183 m contour, and especially at the southeastern end of the island chain and off the north coast of Oahu (Nitta and Henderson 1993; Balazs 1995, 1998). Leatherbacks encountered in these waters, including those caught incidental to fishing operations, may represent individuals in transit from one part of the Pacific Ocean to another (NMFS and USFWS 1998f). Leatherbacks apparently have a wide geographic distribution throughout the region where the Hawaiian longline fishery operates, with sightings and reported interactions commonly occurring around seamount habitats located above the Northwest Hawaiian Islands (from 35° to 45°N and 175° to 180°W) (Skillman and Balazs 1992; Skillman and Kleiber 1998). McCracken (2000) has also documented incidental captures of leatherbacks at several offshore locations around the Main Hawaiian Islands. Although leatherback bycatch events are common occurrences off the archipelago, leatherback stranding events on its beaches are not. Since 1982, only five leatherbacks have stranded in the Hawaiian Islands (NMFS-PIFSC 2004).

Satellite-tracking studies, a lack of Hawaiian stranding records, and occasional incidental captures of the species in the Hawaii-based longline fishery indicate that deep, oceanic waters are the most preferred habitats of leatherback turtles in the central Pacific Ocean. As a result, the area of year-round primary occurrence for the leatherback turtle encompasses all Hawaiian Islands Operating Area waters beyond the 100 m isobath. Inshore of the 100 m isobath is the area of rare leatherback occurrence. This area is also the same year round. Leatherbacks were not sighted during any of the aerial surveys for which data were collected, all of which took place over waters lying in close proximity to the Hawaiian shoreline. Leatherbacks were not sighted during any of the NMFS shipboard surveys either, although their deep diving capabilities and long submergence times lessen the probability that observers will be able to spot them during marine surveys.

Loggerhead Turtle (*Caretta caretta*)

The NMFS and USFWS (1998d) listed four records of this species for the Hawaiian Islands: two from the southeastern end of the archipelago, one from Kure Atoll (recovered from the stomach of a tiger shark), and a fourth from the coast of Oahu (seen just offshore of the Sheraton Waikiki hotel). All four individuals were identified as juvenile loggerheads and most likely drifted or traveled to the region from either Mexico or Japan. A single male loggerhead turtle has also been reported to visit Lehua Channel and Keamano Bay (located off the north coast of Niihau) every June through July (DoN 2001b; NOS 2001). Only one loggerhead stranding has been recorded in the Hawaiian Islands since researchers began documenting them in 1982. This event, which was recorded along the shores of Kaneohe Bay, Oahu, was determined to be the result of a shark attack (NMFS-PIFSC 2004).

Genetic analyses indicate that nearly all of the loggerheads found in the North Pacific Ocean are born on nesting beaches in Japan (Bowen *et al.* 1995; Resendiz *et al.* 1998). Pacific loggerheads appear to utilize the entire North Pacific Ocean during the course of development, much like Atlantic loggerheads use the North Atlantic Ocean. There is substantial evidence that both stocks make two separate transoceanic crossings. The first crossing (west to east) is made immediately after hatching from the nesting beach, while the second (east to west) is made upon reaching either the late juvenile or adult life stage.

The area of primary occurrence for the loggerhead turtle spans all ocean waters off the Main Hawaiian Islands and Nihoa beyond the 100 m isobath. This area, like the area of rare occurrence, which can be found between the Hawaiian Islands shoreline and the 100 m isobath, is the same throughout the year. Occurrence in nearshore waters is believed to be rare due to a lack of sighting and stranding records in those waters. Except for the four sighting and one stranding records listed previously, loggerheads have not been recorded at all on the Hawaiian shelf.

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4.0 ENVIRONMENTAL EFFECTS

This chapter describes the potential environmental consequences of the Proposed Action by comparing the activities with the potentially affected environmental components. Proposed RIMPAC activities were also reviewed against existing environmental documentation on current and planned actions and information on anticipated future projects at each of the sites to determine the potential for cumulative effects. The potential environmental consequences of Alternative 2, which does not include the NEO at PMRF and Niihau, would be the same as described for the Proposed Action in Sections 4.2 and 4.3.

4.1 PMRF AND NIIHAU

RIMPAC activities conducted at PMRF and analyzed in this Supplement include the NEO as described in Chapter 2.0. The NEO activities would be conducted in the Majors Bay area as well as adjacent beach and inland areas as shown in Figure 3-1.

4.1.1 PMRF Biological Resources

Procedures for implementing the NEO would be similar to the Amphibious Landing Exercise, but the NEO involves fewer people and much less equipment; therefore, the impacts would be insignificant. As discussed in Section 4.1.1.3, pg 4-3 of the RIMPAC PEA (Appendix E, 7), potential impacts of past amphibious landings have been monitored. Observations indicate that due to procedures in place at PMRF and continuing public use of the Majors Bay beach area, the impact from an Amphibious Landing Exercise would be insignificant. Within 1 hour prior to initiation of the landing activities, landing routes and beach areas would be determined to be clear of marine mammals and sea turtles. If any are seen, the exercise would be delayed until the animals leave the area.

4.1.2 Niihau Biological Resources

The NEO activities at Niihau would be similar to Special Warfare Operations training events. As discussed in Section 4.1.2.1, pg 4-11 of the RIMPAC PEA (Appendix E, 8), Special Warfare Operations training events on Niihau would utilize existing openings, trails, and roads. Helicopter landings would be in areas designated as suitable and absent of biological resources. Therefore, no impacts to biological resources would be anticipated.

4.1.3 Niihau Cultural Resources

As discussed in Section 4.1.2.2, pg 4-11 of the RIMPAC PEA (Appendix E, 9), no known traditional cultural properties are located within the U.S. Navy's Mobile Operations Area on Niihau. Personnel would take all measures to prevent discovery, including not overturning rocks or digging any soil. Helicopter landings would be in areas designated for suitability and absence of cultural resources. However, it is possible during training events for participants to find a previously unknown site. Training event participants would be briefed on the need to promptly notify U.S. Navy Region personnel if any cultural resources are found so the appropriate coordination could be initiated.

4.2 OCEAN AREA

The training events being analyzed for the Proposed Action and Alternative 2 are not new and have taken place with no significant changes over the previous 19 RIMPAC exercises. However, new scientific information has led to the ability to quantitatively assess potential effects to marine mammals through the use of newly derived threshold criteria. As a result of scientific advances in acoustic exposure effects-analysis modeling on marine mammals, action proponents now have the ability to quantitatively estimate cumulative acoustic exposure on marine mammals. Due to these advances in scientific information, this supplement will document an effects-analysis on marine mammals that may be affected by the RIMPAC training events that use mid-frequency active tactical sonar.

4.2.1 Acoustic Effects on Marine Mammals

The approach for estimating potential acoustic effects from RIMPAC ASW training activities on cetacean species makes use of the methodology that was developed in cooperation with NOAA for the Navy's Draft *Overseas Environmental Impact Statement/Environmental Impact Statement, Undersea Warfare Training Range* (OEIS/EIS) (DoN 2005b). A summary of the approach is presented here.

This section presents the framework within which potential effects can be categorized. Both the Marine Mammal Protection Act (MMPA, as amended, and the Endangered Species Act (ESA) direct which traits should be used when determining effects. Effects that address injury are considered Level A harassment under MMPA. Effects that address behavioral and temporary disruption are considered Level B harassment under MMPA. For ESA, effects that address injury are considered harm (an act which actually kills or injures fish or wildlife). Effects that address behavior are defined as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Under ESA there are also behavioral effects that exceed the normal daily variation in behavior, but which arise without an accompanying physiological effect.

For military readiness activities, Level A harassment under the MMPA includes any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild. Injury, as defined in the Undersea Warfare Training Range Draft OEIS/DEIS (DoN 2005b) and previous rulings (NOAA 2001, 2002), is the destruction or loss of biological tissue. The destruction or loss of biological tissue will result in an alteration of physiological function that exceeds the normal daily physiological variation of the intact tissue.

In 2004, Congress amended the definition of harassment under the MMPA for military readiness activities, such as this action (and also for scientific research on marine mammals conducted by or on the behalf of the Federal government). For military readiness activities, Level B harassment is now defined as "any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered.

The amended definition of Level B harassment serves to clarify and codify NMFS' existing interpretation of Level B harassment, properly focusing on activities that result in significant behavioral changes in biologically important activities, rather than activities with de minimus impacts. Replacement of the threshold standard "potential" with "likely" eliminates from consideration activities with a mere "potential" to have impacts. Unlike Level A harassment, which is solely associated with physiological effects, both physiological and behavioral effects may cause Level B harassment.

The intent of the unique definition of harassment for military readiness activities and specific scientific activities was to provide greater clarity for the DoD and the regulatory agencies, and to properly focus authorization of military readiness and scientific research activities on such biologically significant impacts to marine mammals, a science-based approach.

As described above and as required by NMFS as a Cooperating Agency, the analysis in this EA assumes that short-term non-injurious sound exposure levels (SELs) predicted to cause Temporary Threshold Shift (TTS) or temporary behavioral disruptions qualify as Level B harassment. Application of this criterion assumes an effect even though not every behavioral disruption or instances of TTS will result in the abandonment or significant alteration of behavioral patterns. There is no scientific correlation between mid-frequency active sonar use and marine mammals leaving their habitat in Hawaii.

4.2.1.1 Indicators of Physiological Effects (PTS and TTS)

Very high sound levels may rupture the eardrum or damage the small bones in the middle ear of mammals (Yost 1994). Lower sound levels may cause permanent or temporary hearing loss. Such an effect is called a threshold shift (TS). A TS may be either permanent or temporary. Permanent Threshold Shift (PTS) is used as the criteria for physiological effects resulting in injury, and TTS is used as the criteria for physiological effects that do not result in injury but may result in a behavioral disturbance and/or in harassment.

Use of EL for Physiological Effect Thresholds

Energy Flux Density Level (EL) is a measure of the sound energy flow per unit area expressed in dB. EL is stated in dB re 1 μPa^2-s for underwater sound. Sound Pressure Level (SPL) is a measure of the root mean square, or "effective", sound pressure in decibels. SPL is expressed in dB re 1 µPa for underwater sound. Marine and terrestrial mammal data show that, for continuous-type sounds of interest, TTS and PTS are more closely related to the energy in the sound exposure than to the exposure SPL.

The EL for each individual ping is calculated from the following equation:

$$EL = SPL + 10\log_{10}(\text{duration})$$

The EL includes both the ping SPL and duration. Longer-duration pings and/or higher-SPL pings will have a higher EL.

If an animal is exposed to multiple pings, the energy flux density in each individual ping is summed to calculate the total EL. Since mammalian TS data show less effect from intermittent exposures compared to continuous exposures with the same energy (Ward 1997), basing the effect thresholds on the total received EL is a conservative approach for treating multiple pings; in reality, some recovery will occur between pings and lessen the effect of a particular exposure. Therefore, estimates are conservative because recovery is not taken into account—intermittent exposures are considered comparable to continuous exposures.

Comparison to SURTASS LFA Risk Functions

The effect thresholds described in this RIMPAC Supplement should not be confused with criteria and thresholds used for the Navy's Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar. SURTASS LFA features pings lasting many tens of seconds. The sonars of concern for use during RIMPAC 2006 emit pings lasting a few seconds at most. SURTASS LFA risk functions were expressed in terms of the received "single ping equivalent" SPL. Effect thresholds for RIMPAC are expressed in terms of the total received EL. The SURTASS LFA risk function parameters cannot be directly compared to the effect thresholds proposed in this document.

TTS and PTS Effect Thresholds

The TTS threshold is primarily based on the cetacean TTS data from Schlundt *et al.* (2000). Since these tests used short-duration tones similar to sonar pings, they are the most directly relevant data. The mean exposure EL required to produce onset-TTS in these tests was 195 dB re 1 μPa^2-s. This result is corroborated by the short-duration tone data of Finneran *et al.* (2000, 2003a, 2005) and the long-duration noise data from Nachtigall *et al.* (2003a, 2003b). Together, these data demonstrate that TTS in cetaceans is correlated with the received EL and that onset-TTS exposures equate to an energy level of 195 dB re 1 μPa^2-s.

PTS data do not exist for marine mammals and are unlikely to be obtained. Therefore, PTS levels for these animals must be estimated using TTS data and relationships between TTS and PTS. The 215 dB re 1 μPa^2-s PTS threshold is based on a 20 dB increase in exposure EL over that required for onset-TTS. The 20 dB value is based on extrapolations from terrestrial mammal data indicating that PTS occurs at 40 dB or more of TS, and that TS growth occurs at a rate of approximately 1.6 dB TTS per dB increase in EL. There is a 34 dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB). The additional exposure above onset-TTS that is required to reach PTS is therefore 34 dB divided by 1.6 dB, or approximately 21 dB. This estimate is conservative because (1) 40 dB of TS is actually an upper limit for TTS used to approximate onset-PTS, and (2) the 1.6 dB/dB growth rate is the upper range of values from Ward *et al.* (1958, 1959).

4.2.1.2 Behavioral Effects

The behavioral effects threshold proposed by the Navy (190 dB re 1 μPa^2-s) is based primarily on the behavioral observations reported in Schlundt *et al.* (2000) and Finneran *et al.* (2000, 2003b, 2005). Finneran and Schlundt (2004) summarize these data and provide the statistical analysis used in development of this threshold. These studies are applicable because they used short-duration tones and frequencies similar to the sonar use modeled in this assessment. The most compelling reason for the use of this experimental data using captive animals was the considerable number of studies involved and the absence of any other data using representative sound characteristics and experimental controls. In particular, the studies summarized in Finneran and Schlundt (2004) and their resulting analysis provides the most appropriate data to develop a behavioral effects threshold because: (1) researchers had superior control over and ability to quantify noise exposure conditions; (2) behavioral patterns of exposed marine mammals were readily observable and definable; (3) fatiguing noise consisted of tonal noise exposures with frequencies contained in the tactical mid-frequency sonar bandwidth; and 4) the species involved were closely related to the majority of the animals expected to be within the Hawaiian Islands operational areas. Since no directly comparable data exist, or are likely to be obtained, for wild animals, the relationship between the behavioral results reported by Finneran and Schlundt (2004) and wild animals is unknown. However, data from wild cetaceans exposed to mid-frequency sonar and sounds similar to mid-frequency sonar have been collected, and these data were also considered by NMFS in the development of behavioral effects criteria. Although, experienced, trained subjects may tolerate higher sound levels than inexperienced animals, it is also possible that prior experiences and resultant expectations may have made some trained subjects less tolerant of the sound exposures (see Domjan 1998:41-44). The following paragraphs discuss the applicability of the Finneran and Schlundt (2004) data.

As described in Finneran and Schlundt (2004), the behavior of a subject during intense sound exposure experiments was subjectively compared to the subject's "normal" behaviors to determine whether a subject exhibited altered behavior during a session. In this context, altered behavior means a deviation from a subject's typical trained behaviors. The subjective assessment was only possible because behavioral observations were made with the same subjects during many baseline hearing sessions with no intense sound exposures. This allowed comparisons to be made between how a subject usually acted and how it acted during test sessions with intense sound exposures. Each exposure session was then categorized as "normal behavior" or "altered behavior." The behavioral alterations primarily consisted of reluctance on the part of the subjects, during a test session, to return to the site of a previous intense sound exposure. All instances of altered behavior were included in the statistical summary. An example of the results is as follows: At 192 dB re 1µPa exposure SPL, 7 of 13 white whale sessions and 16 of 32 dolphin sessions were categorized as altered behavior. The pooled percentage is therefore 51%, or 23 of 45 total sessions.

Exposure levels corresponding to sessions with 25, 50, and 75% altered behavior were 180, 190, and 199 dB re 1 µPa SPL (or 180, 190, and 199 dB re 1 μPa^2-s EL), respectively, for the frequency range of 3 to 20 kHz, which is the range of frequencies that will be used in RIMPAC 06. More detailed statistical results are provided in Finneran and Schlundt (2004).

The use of the 50% point (190 dB re 1 μPa^2-s) to estimate a single numeric "all-or-nothing" threshold from a psychometric function is a common and accepted psychophysical technique (e.g., Nachtigall, 2000; Yost, 1994). The 50% altered point from these data is one approach to predicting Level B harassment because it actually represents the sensory threshold point where the sound was strong enough to potentially result in altered behavior in the captive animals 50% of the time; however, it may not result in significantly altered behavior as is required to be considered Level B harassment as defined for military readiness activities.

Although wide-ranging in terms of sound sources, context, and type/extent of observations reported, NMFS believes that the large and growing body of literature regarding behavioral reactions of wild, naive marine mammals to anthropogenic exposure generally suggests that wild animals are behaviorally affected at significantly lower levels than those determined for captive animals by Finneran and Schlundt (2004). For instance, cetaceans exposed to human noise sound sources, such as seismic airgun sounds and low frequency sonar signals, have been shown to exhibit avoidance behavior when the animals are exposed to noise levels of 140-160 dB re: 1μPa under certain conditions (Malme et al., 1983; 1984; 1988; Ljungblad et al., 1988; Tyack and Clark, 1998). Two specific situations for which exposure conditions and behavioral reactions of free-ranging marine mammals exposed to sounds similar to those proposed for use in RIMPAC are considered by Nowacek et al. (2004) and NMFS (2004). Both suggest behavioral alterations, including the alteration of feeding, diving, and social behavior, occur at levels below the 190 dB re 1 μPa^2-s criterion (acknowledging differences in metrics).

Nowacek et al. (2004) conducted controlled exposure experiments on North Atlantic right whales using ship noise, social sounds of con-specifics, and an alerting stimulus (frequency modulated tonal signals between 500 Hz and 4.5 kHz). Animals were tagged with acoustic sensors (D-tags) that simultaneously measured movement in three dimensions. Whales reacted strongly to alert signals at received levels of 133-148 dB SPL, mildly to conspecific signals, and not at all to ship sounds or actual vessels. The alert stimulus caused whales to immediately cease foraging behavior and swim rapidly to the surface. Although SEL values were not directly reported, based on received exposure durations, approximate received values were on the order of 160 dB re 1 μPa^2-s. However, the frequencies used, the modulated tones, and the long duration of the alert stimuli are not the same as Navy mid-frequency sonar and were designed specifically to create a behavioral reaction in North Atlantic right whales, which are not present in Hawaii.

NMFS notes the fact that pure tone exposures in laboratory conditions differ physically in several substantive ways from received tactical sonar signals in real-world conditions. Although pure tone exposures used in the captive TTS studies are certainly more like tactical mid-frequency sonar than certain human sound sources (such as vessels or ice-breaking) involved in less-controlled behavioral studies of wild animals, there are some potentially significant differences between these laboratory noise exposures and the complex frequency modulation and multi-path propagation patterns of tactical sonars in operational environments. Last, there is considerable uncertainty regarding the validity of applying data collected from trained captives conditioned to not respond to noise exposure in setting thresholds for behavioral reactions of naïve wild individuals to a sound source that apparently evokes strong reactions in some marine mammals. However, it is also possible that prior experiences and resultant expectations may have made some trained subjects less tolerant of the sound exposures (see Domjan 1998:41-44).

Given these considerations, NMFS believes that a more conservative acoustic behavioral disturbance threshold for sub-TTS behavioral disturbance than the 190 dB re 1 μPa^2-s criterion is necessary. Acknowledging the quantitative limitations of many of the field observations of marine mammals and the advantages in this regard of the Finneran and Schlundt (2004) analysis, NMFS has set the behavioral effects threshold at 173 dB re 1 μPa^2-s. The Navy has adopted NMFS recommendation to more conservatively apply this science in the analysis for RIMPAC 2006, and will use the 173 dB re 1 μPa^2-s threshold criterion for sub-TTS behavioral Level B takes.

The selection of this threshold criterion has no precedent and its use in this document is not intended to serve as precedent for any future Navy take authorization request. Establishment of an appropriate threshold for analysis will continue to be coordinated between NMFS and the Navy for future actions undertaken pursuant to the Navy's determination that a take authorization is required under the MMPA for any future proposed activity.

4.2.1.3 Likelihood of Prolonged Exposure

The proposed ASW activities during RIMPAC would not result in long-term effects because the vessels are constantly moving, and the flow of the activity in the Hawaiian Islands Operating Area when ASW training occurs reduces the potential for prolonged exposure. The implementation of the protective measures described in Chapter 5 would further reduce the likelihood of any prolonged exposure.

4.2.1.4 Likelihood of Masking

Natural and artificial sounds can disrupt behavior by masking, or interfering with an animal's ability to hear other sounds. Masking occurs when the receipt of a sound is interfered with by a second sound at similar frequencies and at similar or higher levels. If the second sound were artificial, it could be potentially harassing if it disrupted hearing-related behavior such as communications or echolocation. It is important to distinguish TTS and PTS, both of which persist after the sound exposure, from masking, which occurs during the sound exposure.

Historically, principal masking concerns have been with prevailing background noise levels from natural and manmade sources (for example, Richardson *et al.*, 1995). Dominant examples of the latter are the accumulated noise from merchant ships and noise of seismic surveys. Both cover a wide frequency band and are long in duration.

The proposed RIMPAC areas are away from harbors or heavily traveled shipping lanes. The loudest mid-frequency underwater sounds in the Hawaiian Islands Operating Area are those produced by hull mounted mid-frequency active tactical sonar. The sonar signals are likely within the audible range of most cetaceans, but are very limited in the temporal and frequency domains. In particular, the pulse lengths are short, the duty cycle low, and these hull mounted mid-frequency active tactical sonars transmit within a narrow band of frequencies (typically less than one-third octave).

For the reasons outlined above, the chance of sonar operations causing masking effects is considered negligible.

4.2.1.5 Application of Effect Thresholds to Other Species

Mysticetes and Odontocetes

Information on auditory function in mysticetes is extremely lacking. Sensitivity to low-frequency sound by baleen whales has been inferred from observed vocalization frequencies, observed reactions to playback of sounds, and anatomical analyses of the auditory system. Baleen whales are estimated to hear from 15 Hz to 20 kHz, with good sensitivity from 20 Hz to 2 kHz (Ketten, 1998). Filter-bank models of the humpback whale's ear have been developed from anatomical features of the humpback's ear and optimization techniques (Houser et al., 2001). The results suggest that humpbacks are sensitive to frequencies between 40 Hz and 16 kHz, but best sensitivity is likely to occur between 100 Hz and 8 kHz. However, absolute sensitivity has not been modeled for any baleen whale species. Furthermore, there is no indication of what sorts of sound exposure produce threshold shifts in these animals.

The criteria and thresholds for PTS and TTS developed for odontocetes for this activity are also used for mysticetes. This generalization is based on the assumption that the empirical data at hand are representative of both groups until data collection on mysticete species shows otherwise. For the frequencies of interest for this action, there is no evidence that the total amount of energy required to induce onset-TTS and onset-PTS in mysticetes is different than that required for odontocetes.

Beaked Whales

Recent beaked whale strandings have prompted inquiry into the relationship between mid-frequency active sonar and the cause of those strandings. Several suggested causes of those strandings are described in Section 4.2.1.6. In the one stranding where U.S. Navy mid-frequency active tactical sonar has been identified as the most plausible contributory source to the stranding event (in the Bahamas in 2000), the Navy participated in an extensive investigation of the stranding with NMFS (DoC and DoN 2001). The specific mechanisms that led to the Bahamas stranding are not understood and there is uncertainty regarding the ordering of effects that led to the stranding. It is uncertain as to whether beaked whales were directly injured by sound (a physiological effect) prior to stranding or whether a behavioral response to sound occurred that ultimately caused the beaked whales to strand and be injured.

The "Joint Interim Report, Bahamas Marine Mammal Stranding Event of 15-16 March 2000" (DoC and DoN 2001) concluded that environmental and biological factors, including (1) intensive use of multiple sonar units; (2) whale presence, especially beaked whale species; (3) surface duct presence; (4) high relief bathymetry such as seamounts and canyons; and (5) a constricted channel with limited egress (approximately 19 nmi wide by 100 nmi long) were contributory factors to the Bahamas stranding.

During the RIMPAC Exercise there will be intensive use of multiple sonar units and three beaked whale species that may be present in the same vicinity. A surface duct may be present in a limited area for a limited period of time. Most of the ASW training events take place in the deep ocean well removed from areas of high bathymetric relief. Although some of the training events will take place in such areas, none of the training events will take place in a location having a constricted channel with limited egress similar to the Bahamas. Consequently, the confluence of factors believed to contribute to the Bahamas stranding are not present in the Hawaiian Islands and will therefore not be present during RIMPAC. NMFS believes caution should be used anytime any of the other three factors are present in addition to the presence of beaked whales and the operation of mid-frequency sonar.

Separate and meaningful effects thresholds cannot be developed specifically for beaked whales because the exact causes of beaked whale strandings are currently unknown. However, since use of mid-frequency active tactical sonar is required for RIMPAC training events, NMFS has required that, as a condition of the MMPA permit, the RIMPAC Supplement take a conservative approach and treat all predicted behavioral disturbance of beaked whales as potential non-lethal injury. All predicted Level B harassment of beaked whales is therefore given consideration as non-lethal Level A harassment. Based on decades of ASW training having occurred in the Hawaiian Islands, including 19 previous RIMPAC exercises, and no evidence of any beaked whale strandings having occurred in the timeframe of those events or otherwise associated with any of those events, it is extremely unlikely that any significant behavioral response will result from the interaction of beaked whales and the use of sonar during the RIMPAC Exercise.

4.2.1.6 Other Effects Considered

Acoustically Mediated Bubble Growth

One suggested cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. This process is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). Deeper and longer dives of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater supersaturation (Houser et al., 2001b). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness.

It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. Yet another hypothesis has speculated that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson et al., 2003). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Collectively, these hypotheses can be referred to as “hypotheses of acoustically mediated bubble growth.”

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). To date, ELs predicted to cause in vivo bubble formation within diving cetaceans have not been evaluated (NOAA, 2002b). Further, although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson et al., 2003), there is no conclusive evidence of this. Because evidence supporting it is debatable, no marine mammals addressed in this RIMPAC Supplement are given special treatment due to the possibility for acoustically mediated bubble growth. Beaked whales are, however, assessed differently from other species to account for factors that may have contributed to prior beaked whale strandings as set out in the previous section.

Resonance

Another suggested cause of injury in marine mammals is air cavity resonance due to sonar exposure. Resonance is a phenomenon that exists when an object is vibrated at a frequency near its natural frequency of vibration – the particular frequency at which the object vibrates most readily. The size and geometry of an air cavity determine the frequency at which the cavity will resonate. Displacement of the cavity boundaries during resonance has been suggested as a cause of injury. Large displacements have the potential to tear tissues that surround the air space (for example, lung tissue).

Understanding resonant frequencies and the susceptibility of marine mammal air cavities to resonance is important in determining whether certain sonars have the potential to affect different cavities in different species. In 2002, NMFS convened a panel of government and private scientists to address this issue (NOAA, 2002b). They modeled and evaluated the likelihood that Navy mid-frequency active tactical sonar caused resonance effects in beaked whales that eventually led to their stranding (DoC and DoN, 2001). The conclusions of that group were that resonance in air-filled structures was not likely to have caused the Bahamas stranding (NOAA, 2002b). The frequencies at which resonance was predicted to occur were below the frequencies utilized by the sonar systems employed. Furthermore, air cavity vibrations due to the resonance effect were not considered to be of sufficient amplitude to cause tissue damage. By extension, this RIMPAC Supplement assumes that similar phenomenon would not be problematic in other cetacean species for the RIMPAC ASW events.

4.2.1.7 Acoustic Effects Analysis Modeling

In order to estimate acoustic effects from the RIMPAC ASW operations, acoustic sources to be used were examined with regard to their operational characteristics. Systems with acoustic source levels below 205 dB re 1 µPa @ 1 m were not included in the analysis given that at this source level (205 dB re 1 µPa @ 1 m) or below, a 1-second ping would attenuate below the sub-TTS behavioral disturbance threshold of 173 dB within a distance of about 100 meters. As additional verification, sources at this level were examined typically using simple spreadsheet calculations to ensure that they did not need to be considered further. For example, a sonobuoys typical use yielded an exposure area that produced 0 marine mammal exposures based on the maximum animal density. Such a source was called non-problematic and was not modeled in the sense of running its parameters through the environmental model (CASS), generating an acoustic footprint, etc. The proposed counter measures source level was less than 205 dB but its operational modes were such that a simple "look" was not applicable, and a separate study was conducted to ensure it did not need to be considered further.

In addition, systems with an operating frequency greater than 100 kHz were not analyzed in the detailed modeling as these signals attenuate rapidly resulting in very short propagation distances. Acoustic countermeasures were previously examined and found not to be problematic. The AN/AQS 13 (dipping sonar) used by carrier-based helicopters was determined in the *Environmental Assessment/Overseas Environmental Assessment of the SH-60R Helicopter/ALFS Test Program*, October 1999 not to be problematic due to its limited use and very short pulse length (2-5 pulses of 3.5-700 msec). Since 1999, during the time of the test program, there have been over 500 hours of operation, with no environmental effects observed. The Directional Command Activated Sonobuoy System (DICASS) sonobuoy was determined not to be problematic having a source level at 201dB re 1 µPa @ 1m. These acoustic sources, therefore, did not require further examination in this analysis.

Based on the information above, only hull mounted mid-frequency active tactical sonar was determined to have the potential to affect marine mammals protected under the MMPA and ESA during RIMPAC ASW training events.

The modeling for surface ship active tactical sonar occurred in five broad steps, listed below. Results were calculated based on the typical ASW activities planned for RIMPAC 2006. Acoustic propagation and mammal population data are analyzed for the July timeframe because RIMPAC occurs in July. Marine mammal survey data for the offshore area beyond 25 nmi (Barlow 2003) and survey data for nearshore areas within 25 nmi; (Mobley et al. 2000) provided marine mammal species density for modeling.

Step 1. Perform a propagation analysis for the area ensonified using spherical spreading loss and the Navy's Gaussian Ray Bundle (GRAB) program, respectively.

Step 2. Convert the propagation data into a two-dimensional acoustic footprint for the acoustic sources engaged in each training event as they move through the six acoustic exposure model areas.

Step 3. Calculate the total energy flux density level for each ensonified area summing the accumulated energy of all received pings.

Step 4. Compare the total energy flux density to the thresholds and determine the area at or above the threshold to arrive at a predicted marine mammal effects area.

Step 5. Multiply the effects areas by the corresponding mammal population density estimates (in Appendix C). Sum the products to produce species sound exposure rate. Analyze this rate based on the annual number of events for each exercise scenario to produce annual acoustic exposure estimates.

The analysis estimated the sound exposure for marine mammals produced by each sonar training event in each of the six acoustic exposure model areas. While ASW events could occur throughout the approximate 210,000 square nmi of the Hawaiian Islands Operating Area, most events would occur within the approximate 46,000 square nmi of these six areas that were used for analysis as being representative of the marine mammal habitats and the bathymetric, seabed, wind speed, and sound velocity profile conditions within the entire Hawaiian Islands Operating Area.

The movement of various units during an ASW event is largely unconstrained and dependent on the developing tactical situation presented to the commander of the forces. Modeling inputs for these highly variable events were developed using actual hours of ASW operation and ship position data during RIMPAC 2004 events. The data from RIMPAC 2004 was then cross-checked against the preferred force deployment that should result from following the latest tactical training. The result of this analysis was that modeling inputs for surface ship mid-frequency active tactical sonar was 532 hours of sonar operation, in 44 ASW events, occurring during 10 exercise periods over 21 days. This total includes all potential ASW training that is expected to occur during RIMPAC.

Appendix C includes the results of the acoustic effects analysis modeling.

4.2.1.8 Acoustic Effects Criteria and Thresholds

Table 4-1 and Figure 4-1 summarize the acoustic effects criteria and thresholds used in this assessment. The figure is intended to illustrate the general relationships between effects zones and does not represent the sizes or shapes of the actual zones.

Table 4-1 Acoustic Effects Criteria and Thresholds

Criteria	Threshold (dB re 1 µPa^2-s EL)	MMPA Definitions	ESA Definitions
PTS	215	Level A	Harm
TTS	195	Level B	Harassment
Sub-TTS Behavioral disturbance without physiological effects	173	Level B	Harassment

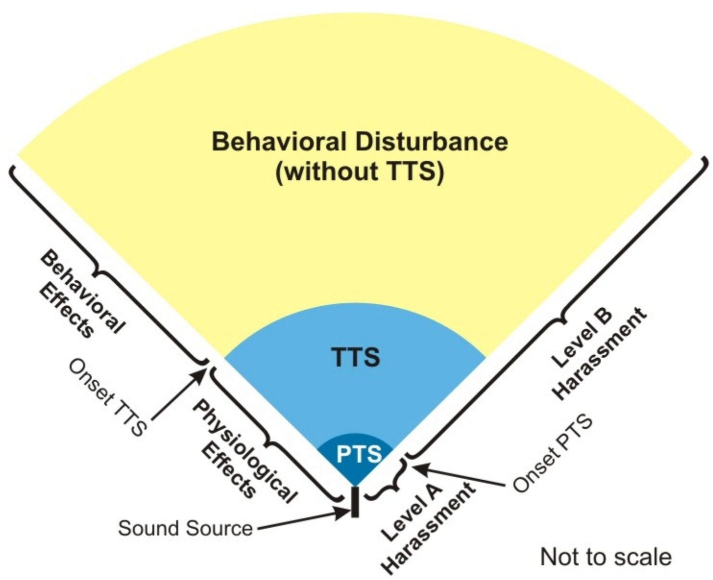

Figure 4-1 Summary of the Acoustic Effects Criteria and Thresholds

Marine Mammal Protection Act (MMPA)—Marine mammals predicted to receive a sound exposure with EL of 215 dB re 1 µPa^2-s or greater are assumed to experience PTS and are counted as Level A harassment. Marine mammals predicted to receive a sound exposure with EL greater than or equal to 195 dB re 1 μPa^2-s but less than 215 dB re 1 μPa^2-s are assumed to experience TTS and are counted as Level B harassment. In addition, all marine mammals predicted to receive a sound exposure with EL greater than or equal to 173 dB re 1 μPa^2-s but less than 195 dB re 1 μPa^2-s are assumed to experience behavioral disturbance and are also counted as Level B harassment. The only exception to this approach is the post-modeling consideration for beaked whales as described in Section 4.2.1.5.

Based on the acoustic model results for RIMPAC, no marine mammals are predicted to experience a sound exposure equal to or greater than an EL of 215 dB re 1 μPa^2-s. Therefore, modeling of acoustic effects indicates that the ASW events during RIMPAC would not result in any Level A harassment. However, the Level B harassment predicted for beaked whales is treated as non-lethal Level A harassment.

Endangered Species Act (ESA)—*Potential for injury constituting harm under the ESA*—ESA regulations define harm as "an act which actually kills or injures" fish or wildlife (50 CFR § 222.102). Based on this definition, the criterion applied here is PTS, a permanent noise-induced hearing loss. PTS is non-recoverable and as defined within this analysis, must result from the destruction of tissues within the auditory system. In this analysis, the smallest amount of PTS (onset-PTS) is taken to be the indicator for the smallest degree of injury that can be measured. The acoustic exposure associated with onset-PTS (EL of 215 dB re 1 μPa2-s or greater) is used to define the outer limit of the zone within which listed species are considered to potentially experience harm.

Based on the acoustic model results for RIMPAC, no endangered or threatened marine mammals are predicted to experience this sound exposure level. Therefore, the ASW events during RIMPAC would not harm any endangered or threatened marine mammals.

Potential for non-injurious physiological effects constituting harassment under the ESA—ESA regulations define harassment as an "intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR § 17.3). In this assessment, the smallest measurable amount of TTS, onset-TTS, is taken as the best indicator for slight temporary sensory impairment. TTS is recoverable and, as in recent rulings (NOAA 2001, 2002), is considered to result from the temporary, non-injurious distortion of hearing-related tissues. Because it is considered non-injurious, the acoustic exposure associated with onset-TTS (EL greater than or equal to 195 dB re 1 μPa^2-s) is used to define the outer limit of the zone within which listed species are predicted to experience harassment attributable to physiological effects. This follows from the concept that even temporary hearing loss at a single frequency potentially affects an animal's ability to react normally to the sounds around it.

Potential for behavioral effects without physiological effects constituting harassment under the ESA—Acoustic exposure may result in behavioral effects that exceed the normal daily variation in behavior, but which arise without an accompanying physiological effect. In this assessment, these effects are also considered "harassment" under the ESA. This "zone" extends to a point at which no significant disruption in normal behavioral patterns occurs. The acoustic exposure of EL greater than or equal to 173 dB re 1 μPa^2-s is used to define the outer limit of the zone within which listed species are considered to potentially experience harassment attributable to behavioral effects without physiological effects.

4.2.1.9 Estimated Acoustic Effects on Marine Mammals (MMPA)

When analyzing the results of the acoustic exposure modeling to provide an estimate of effects, it is important to understand that there are limitations to the ecological data used in the model, and that the model results must be interpreted within the context of a given species' ecology.

When reviewing the acoustic effects modeling results, it is also important to understand that the estimates of marine mammal sound exposures are presented *without* consideration of standard protective operating procedures or the fact that there have been no confirmed acoustic effects to any marine species in the previous 19 RIMPAC Exercises or from any other mid-frequency active sonar training events within the Hawaiian Islands Operating Area. One event that may involve acoustic exposures occurred in Hanalei Bay in July, 2004 and is described in Section 4.2.1.9.1 and Appendix D.

As described above, the model results included no Level A harassment from the RIMPAC 2006 exercise. However, as described in Section 4.2.1.5, all predicted Level B harassment of beaked whales is treated as non-lethal Level A harassment. All Level B harassment would be short term and temporary in nature. In addition, the short-term non-injurious exposures predicted to cause TTS or temporary behavioral disruptions are considered Level B harassment in this supplement even though it is highly unlikely that the disturbance would be to a point where behavioral patterns are abandoned or significantly altered. The proposed RIMPAC Exercise would only occur during 1 month every 2 years, further reducing the potential to affect marine mammals as a result of repeated use over time.

The modeling for RIMPAC 2006 analyzed the potential interaction of mid-frequency active tactical sonar with marine mammals that occur in the Hawaiian Islands Operating Area. The modeled harassment numbers by species and location are presented in Table 4-2 and indicate the potential Level B harassment exposures during RIMPAC. There is no predicted Level A harassment and so all numbers on the table represent Level B harassment. The table includes the number of estimated harassments for each species within each RIMPAC ASW acoustic model area. The harassment estimates have been rounded to the nearest integer since an estimated harassment of $0.5 \leq 1 < 1.5$ animals is considered one animal for MMPA. Appendix C presents the results of the marine mammal acoustic effect modeling conducted for RIMPAC 2006.

As shown on the table, endangered species with potential incidental harassment are sperm whale, fin whale, sei whale, and monk seal. Potential impacts to these species are discussed in Section 4.2.1.10. Table 4-2 also includes *Stenella* spp. (spotted dolphins), unidentified dolphin, unidentified beaked whale, and unidentified cetacean. This is from the density data that was input to the model. Since the density of sei whales is unknown, potential sei whale exposures were calculated using the modeled number of fin whale exposures and the ratio of sei whale Hawaiian stock to the fin whale Hawaiian stock, to approximate the number of sei whales exposures.

Table 4-2 RIMPAC Mid-Frequency Active Tactical Sonar Acoustic Model Results

MARINE MAMMAL SPECIES	RIMPAC ASW MODELING AREA All numbers are Level B harassment						TOTALS		
	1	2	3	4	5	6	TTS Total	Sub-TTS Total	TOTAL
Rough-toothed dolphin	8	1,880	381	162	329	1,098	49	3,809	3,858
Dwarf sperm whale	8	1,769	627	153	355	1,034	48	3,898	3,946
Fraser's dolphin	7	1,565	317	135	314	915	41	3,212	3,253
†Cuvier's beaked whale	5	1,193	220	103	239	697	29	2,428	2,457
Spotted dolphin	9	2,013	406	173	405	1,175	52	4,129	4,181
Striped dolphin	5	994	601	86	199	579	26	2,438	2,464
Short-finned pilot whale	6	1,432	290	124	287	836	37	2,938	2,975
Pygmy sperm whale	3	650	135	58	136	399	14	1,367	1,381
*Sperm whale	6	692	145	60	141	407	34	1,417	1,451
Bottlenose dolphin	3	562	114	48	92	329	11	1,137	1,148
Melon-headed whale	2	327	64	28	66	138	4	621	625
Spinner dolphin	6	1,303	283	121	281	819	37	2,776	2,813
Risso's dolphin	1	178	45	19	45	158	3	443	446
†Blainville's beaked whale	1	178	45	19	45	158	3	443	446
†Longman's beaked whale	0	67	14	6	14	39	0	140	140
Pygmy killer whale	0	67	14	6	14	39	0	140	140
Bryde's whale	0	47	9	4	9	27	0	96	96
Killer whale	0	47	9	4	9	27	0	96	96
*Fin whale	1	31	7	2	6	17	3	61	64
False killer whale	0	66	14	6	13	38	0	137	137
*Sei whale[1]	0	13	3	1	3	8	1	27	28
*Blue whale	0	0	0	0	0	0	0	0	0
Minke whale	0	0	0	0	0	0	0	0	0
Stenella spp.	1	201	40	17	40	116	3	412	415
Unidentified dolphin	2	305	70	30	68	201	4	672	676
†Unidentified beaked whale	0	36	7	3	6	22	0	74	74
Unidentified cetacean	0	11	1	1	2	5	0	20	20
*Monk seal[1]	0	1	0	0	0	0	1	0	1
TTS Total	2	232	53	9	31	73	400		
Sub-TTS Total	72	15,396	3,808	1,360	3,087	9,208		32,931	
Total Sub-TTS and TTS by Location	74	15,628	3,861	1,369	3,118	9,281			33,331

Notes:

* Endangered Species

† Beaked whales

[1] Calculated using percentage of fin whale Hawaiian stock. Sei is 44% of fin. Monk seal is 32% of fin.

Although there are no density figures for blue whales or North Pacific right whales, given their rare occurrence and presumed relative low abundance, it is unlikely that modeled exposures would result in harassments even if density numbers were available. Humpback whales utilize Hawaiian waters as a major breeding ground during winter and spring (November through April). Minke whales also occur seasonally in Hawaii from November through March. Based on their seasonal migrations, humpback and minke whales should not be present during the RIMPAC Exercise, which takes place in mid-summer, typically late June through July.

There are approximately 55 monk seals in the main Hawaiian Islands (DoN 2005a). Since density numbers are not available for pinnipeds, potential exposures were calculated using the modeled number of fin whale exposures and the ratio of monk seal Hawaiian stock to the fin whale Hawaiian stock, to approximate the number of monk seal exposures. Based on discussions with NMFS, only potential TTS exposures are considered for monk seals. This analysis indicates that one (1) monk seal would be exposed to sound levels above the TTS thresholds. Given monk seals' relative low abundance, it is unlikely that modeled exposures would result in harassment. In addition, the majority of the sonar training events will take place in the deep ocean, far offshore of the main islands and therefore, far away from areas generally utilized by monk seals. There have only been a few sightings of the Northern elephant seal in the Hawaiian Islands, and so they were not modeled given it is extremely unlikely they would be present in the main Hawaiian Islands during RIMPAC 2006.

As described in Section 4.2.1.5, beaked whales are due special concern given that a stranding event in the Bahamas Islands in 2000 and a few other less documented events in other areas of the world suggest that beaked whales may be particularly susceptible to being affected by mid-frequency active sonar; however, one recent study does not support the hypothesis that these species have a particularly high auditory sensitivity at the frequencies used in mid range sonar (Mandy, et al, 2006). Since the exact causes of the beaked whale stranding events are unknown, separate, meaningful impact thresholds cannot be derived specifically for beaked whales. However, since use of mid-frequency active tactical sonar is proposed during RIMPAC training events, this Supplement takes a conservative approach and treats all behavioral disturbance of beaked whales as a potential non-lethal injury. All predicted Level B harassment of beaked whales is therefore counted as Level A harassment. As shown in Table 4-2, there are three species of beaked whales present in the Hawaiian Islands that were modeled as potentially being exposed to sound levels resulting in Level B harassment. Cuvier's beaked whales (n=2,457), Blainville's beaked whales (n=446), Longman's beaked whales (n=140), and 74 unidentified beaked whales had the potential to be affected. These sound exposure numbers are conservatively accounted for as Level A harassment. However, based on operational characteristics and environmental conditions, it is not anticipated that the predicted incidental exposures of beaked whales to acoustic harassment from RIMPAC sources would constitute serious injury or mortality. In addition, there have been 19 previous RIMPAC Exercises and numerous other ASW training events in the Hawaiian Islands Operating Area without stranding any beaked whale species. Thus the Navy concludes that the Proposed Action would not affect annual rates of recruitment or survival for beaked whales.

When looking at the acoustic model results presented in Table 4-2 it is important to remember that although not considered in the modeling, the protective measures described in

Chapter 5 will reduce the likelihood of potential marine mammal harassment. It is likely that Navy ships will detect marine mammals in their vicinity. Navy ships always have two, although usually more, personnel on watch serving as lookouts. In addition to the qualified Lookouts, the Bridge Team is present that at a minimum also includes an Officer of the Deck and one Junior Officer of the Deck whose responsibilities also include observing the waters in the vicinity of the ship. Other observers may include crews of airborne helicopters and P-3 aircraft who also observe the ocean surface for signs indicative of submarines. These aerial observers are also likely to spot any marine mammals in their vicinity and report those observations to vessels engaged in the training events.

It is the duty of the lookouts to report to the officer in charge, the presence of any object, disturbance, discoloration in the water (since they may be indicative of a submarine's presence), or marine mammal within sight of the vessel. At night, personnel engaged in ASW training events may also employ the use of night vision goggles and infrared detectors, as appropriate that can also aid in the detection of marine mammals. Passive acoustic detection of vocalizing marine mammals is also used to alert bridge lookouts to the potential presence of marine mammals in the vicinity. Surface ships utilize a hydrophone that receives all sounds, such as marine mammal vocalizations, and transmit the sound to speakers located on the bridge and in the sonar station. When the mid-frequency sonar is not active, it is in receive mode and, in this passive mode, is continually monitored by the sonar operators.

Consideration of negligible impact is required by NMFS to authorize incidental take of marine mammals. By definition, an activity has a "negligible impact" on a species or stock when it is determined that the total taking is not likely to reduce annual rates of adult survival or annual recruitment (i.e., offspring survival, birth rates). Additionally, the activity will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses. The overall conclusion is that effects to marine mammal species or stocks from RIMPAC ASW training events would be negligible for the following reasons:

- All acoustic exposures are within the non-injurious TTS or behavioral effects zone.
- Although numbers presented in Table 4-2 represent estimated harassment under the MMPA, as described above, application of conservative assumptions in the methodology likely results in an overestimated number of harassments by behavioral disturbance. In addition, the model calculates harassment without taking into consideration standard protective measures, and is not indicative of a likelihood of either injury or harm.
- Additionally, the protective measures described in Chapter 5 are designed to reduce sound exposure of marine mammals to levels below those that may cause "behavioral disruptions."

The Navy will coordinate with NMFS during the MMPA permitting process regarding the effectiveness of protective measures and the likelihood that the protective measures will reduce potential acoustic effects on marine mammals.

4.2.1.9.1 Melon-headed Whale Stranding Event in July 2004

The following paragraphs provide a summary of the stranding event and the Navy ASW operations that were in progress near Kauai. Appendix D includes scientific investigations into the stranding event.

Description of the Stranding Event— the majority of the following information on the stranding event was provided by Dr. Robert Braun, NMFS Pacific Islands Fisheries Science Center in Honolulu, Hawaii. At Hanalei Bay, Kauai on the morning of July 3, 2004, two individuals attending a canoe blessing ceremony noted that as the ceremony began (on time at 7 a.m.), melon-headed whales were seen entering the bay (Braun 2005). They reported that the whales entered across the center of the bay in a "wave" as if they were chasing fish (Braun 2005). The whales were moving fast, but not at maximum speed. The whales stopped in the southwest portion of the bay grouping tightly with lots of spy hopping and tail slapping. As people went in the water among the whales, spy hopping increased and the pod separated into two groups with individual animals moving between the two clusters (Braun 2005). This continued through most of the day, with the animals slowly moving south and then southeast within the bay. (Braun 2005) By about 3 p.m. police arrived and kept people from interacting with the animals. At 4:45 p.m. on July 3, 2004, the RIMPAC Battle Watch Captain received a call from a National Marine Fisheries representative in Honolulu, Hawaii, reporting the sighting of as many as 200 melon-headed whales in Hanalei Bay. At 4:47 p.m., out of caution, the Battle Watch Captain directed all ships in the area to cease all active sonar transmissions.

A National Marine Fisheries Service representative arrived at Hanalei Bay at 7:20 p.m. on July 3, 2004, and observed a tight single pod 75 yards from the southeast side of the bay (Braun 2005). The pod was circling in a tight group and there was frequent tail slapping and minimal spy hopping. Occasionally one or two sub-adult sized animals broke from the tight pod and came nearer the shore to apparently chase fish and be in the shore break (Braun 2005). The pod stayed in the bay through the night of July 3, 2004.

On July 4, 2004, a 700–800-foot rope was constructed by weaving together beach morning glory vines. This vine rope was tied between two canoes and with the assistance of 30 to 40 kayaks, by about 11:30 a.m. on July 4, 2004, the pod was coaxed out of the bay (Braun 2005).

The following morning on July 5, 2004, a very young melon-headed whale was found stranded dead on the beach at Hanalei. NMFS undertook a necropsy to attempt to determine cause of death. Preliminary findings indicated the cause of death was starvation (Farris 2004).

Description of Navy Activities During the Stranding Event—Three ships conducted sonar operations south and southwest of Oahu at 10:15 a.m. to 10:25 a.m., 11:00 to 11:30 a.m., and 13:18 to 13:51 p.m respectively. Beginning at 4:30 p.m. on July 2, 2004, through 12:27 a.m. on July 3, 2004, six ships conducted sonar operations at various times between the islands of Oahu and Kauai. Hanalei Bay, located on the north shore of Kauai, would have been in the acoustic shadow of any sound propagating from this event. The ships' course resembled the lower two portions of the letter "Z" starting from the lower right-hand corner at 4:30 p.m.

and concluding sonar activities at the upper right-hand part of the letter at 12:27 a.m. At approximately 8 p.m., the ships reached the lower left-hand corner of the letter 18 nmi (20.71 miles) southeast of the island of Kauai. The three remaining ships that conducted sonar operations then headed northeast and then east-northeast before heading north during the final 26 minutes of sonar activity. When the ships concluded sonar operations at 12:27 a.m., they were about 60 nmi (69 miles) east of Hanalei Bay, which would still be in the acoustic shadow. The maximum number of ships operating sonar at any one time was three. Although sonar cannot conclusively ruled out as a cause, it is improbable that 200 melon headed whales would continue swimming for 6.5 hours after the sonar transmissions ceased ending up in Hanalei Bay as a result of a behavioral reaction to sonar exposure.

At 6:45 a.m. on July 3, 2004, on the Pacific Missile Range Facility, approximately 25 nmi from Hanalei Bay, active sonar was tested prior to the start of an ASW event; this was about fifteen minutes before the whales were seen in Hanalei Bay. At the nominal swim speed for melon-headed whales (5 to 6 knots), the whales had to be within 1.5 to 2 nmi of Hanalei Bay before the sonar at PMRF was activated. The whales were not in their open ocean habitat but had to be close to shore at 6:45 a.m. when the sonar was activated, to have been observed in Hanalei Bay by 7:00 a.m. Although it is not impossible, the preceding facts suggest it is improbable that the morning sonar transmissions caused the whales to enter the bay. The fact the melon headed whales did not leave the bay when the active sonar use ceased on July 3 at 4:47 p.m., might further support this conclusion.

The area between the islands of Oahu and Kauai, and the PMRF training range have been used in past RIMPAC exercises and are used year-round for ASW training using mid frequency active sonar. Melon-headed whales inhabiting the waters around Kauai are likely not naive to the sound of sonar and there has never been another stranding event associated in time with ASW training at Kauai or in the Hawaiian Islands. Marine mammal strandings in Hawaii are relatively rare. Two melon-headed whales stranded at Hauula Beach on Oahu in August, 2003 (Honolulu Advertiser July 6, 2004). A report of a pod entering Hilo Bay in the 1870s indicates that on at least one other occasion, melon-headed whales entered a bay in a manner similar to the occurrence at Hanalei Bay in July 2004 (see Appendix D).

There are many possible causes for whales appearing in Hanalei Bay (such as following prey as initial reports suggested) and many possible causes for stranding, including sick individual members of a pod. Clearly the starvation death of a newborn whale was not caused by RIMPAC naval activities. Although there will be no definitive answers to why the whales entered Hanalei Bay on the morning of July 3, 2004, based on a preliminary analysis, NMFS cannot conclude that it was impossible that sonar transmissions caused the behavioral responses in the melon-headed whales on July 3, 2004. NMFS is conducting a more thorough analysis of the event and, when completed, a report will be made available to the public. The Navy will be prepared to cease active sonar use if there are indications that an event similar to the 2004 Hanalei Bay event is occurring during an ASW training event.

4.2.1.10 Estimated Acoustic Effects on ESA Listed Species

The endangered species that may be affected by the Proposed Action include the North Pacific right whale (*Eubalaena japonica*), the humpback whale (*Megaptera novaeangliae*), the sei whale *(Balaenoptera borealis)*, the fin whale (*Balaenoptera physalus*), the blue whale

(*Balaenoptera musculus*), the sperm whale (*Physeter macrocephalus),* the Hawaiian monk seal (*Monachus schauinslandi*), the loggerhead sea turtle (*Caretta caretta*), the green sea turtle (*Chelonia mydas)*, the hawksbill sea turtle (*Eretmochelys imbricata*), the leatherback sea turtle (*Dermochelys coriacea*), and the olive ridley sea turtle (*Lepidochelys olivacea*).

Based on seasonal distribution patterns and habitat preferences, the humpback whale, the blue whale, and the North Pacific right whale are not expected to be encountered during the timeframe of the Proposed Action, and thus were not included in the acoustic effects exposure model.

Acoustic exposure model results indicate that no ESA listed species would be exposed to energy that could result in a PTS, or Level A harassment under the MMPA. Additionally, the acoustic exposure model predicts that some ESA listed species may be exposed to acoustic energy that could result in TTS or behavioral modification. All harassment resulting from exposure to acoustic sources would be short term and temporary in nature. Any disturbance that may occur would not be to a point where natural behavioral patterns would be abandoned or significantly altered. The proposed RIMPAC Exercise would only occur during 1 month every 2 years, further reducing the potential to affect ESA listed species as a result of repeated use over time.

A discussion of the potential effects of the Proposed Action on threatened and endangered species recruitment or survival follows.

Cetaceans

Sperm Whale—The abundance estimate of sperm whales in the EEZ of the Hawaiian Islands is 7,082 (Coefficient of Variation [CV]=0.30) (Barlow 2003). Estimates from Calambokidis *et al*. (1997) and Baker and Herman (1987) suggest that the stock has increased in abundance. The acoustic effects analysis predicts that RIMPAC training events could result in the exposure of approximately 1,451 sperm whales to accumulated acoustic energy in excess of 173 dB re 1 μPa^2-s. Of these exposure estimates, 34 would be exposed to accumulated acoustic energy between 195-215 dB re 1 μPa^2-s and 1,417 between 173-195 dB re 1 μPa^2-s. It is likely, however, that posted observers would detect sperm whales at the surface given their large size (probability of trackline detection = 0.87; Barlow 2003), pronounced blow, and mean group size of approximately 8 animals. Due to their ability to remain submerged for long periods of time, it is possible that sperm whales could be present in the vicinity of a RIMPAC ASW training event, and not visually detected.

Even in the event that sperm whales are present in the vicinity of a RIMPAC ASW event and remain undetected, the behavioral disturbance predicted in the acoustic model would be insignificant. While Watkins *et al.* (1985) observed that sperm whales exposed to 3.25 kHz to 8.4 kHz pulses interrupted their activities and left the area, other studies indicate that, after an initial disturbance, the animals return to their previous activity. During playback experiments off the Canary Islands, André *et al.* (1997) reported that foraging whales exposed to a 10 kHz pulsed signal did not exhibit any general avoidance reactions. When resting at the surface in a compact group, sperm whales initially reacted strongly then ignored the signal completely (André *et al.*, 1997). Even though any undetected sperm whales transiting the proposed RIMPAC ASW training areas may exhibit a reaction when initially exposed to active acoustic energy, field observations indicate the effects would not cause disruption of natural behavioral patterns to a point where such behavioral patterns would be abandoned or significantly altered, and therefore the potential effects would be insignificant.

Fin Whale—The abundance estimate of fin whales in the EEZ of the Hawaiian Islands is 174 (CV = 0.77) within only the offshore water habitat (density estimate of 0.0001/km^2). The acoustic effects analysis predicts that RIMPAC training events could result in the exposure of approximately 64 fin whales to accumulated acoustic energy in excess of 173 dB re 1 µPa^2-s. Of these exposure estimates, 3 would be exposed to accumulated acoustic energy between 195-215 dB re 1 µPa^2-s and 61 between 173-195 dB re 1 µPa^2-s.

It is likely that posted observers would detect fin whales at the surface given their large size (probability of trackline detection = 0.90; Barlow 2003) and pronounced blow. In the rare event that fin whales are present in the proposed RIMPAC areas, any potential behavioral disturbance from exposure to hull mounted mid-frequency active tactical sonar would not be significant. Fin whales primarily produce low frequency calls (below 1 kHz) with source levels up to 186 dB re 1µPa at 1 m, although it is possible they produce some sounds in the range of 1.5-28 kHz (review by Richardson et al. 1995). There are no audiograms of baleen whales but they tend to react to anthropogenic sound below 1 kHz suggesting that they are more sensitive to low frequency sounds (Richardson et al. 1995). In the St. Lawrence estuary area, fin whales avoided vessels with small changes in travel direction, speed and dive duration and slow approaches by boats usually caused little response (MacFarlane 1981). Fin whales continued to vocalize in the presence of boat noise (Edds and Macfarlane 1987). Even though any undetected fin whales transiting the proposed RIMPAC ASW training areas may exhibit a reaction when initially exposed to active acoustic energy, field observations indicate the effects would not cause disruption of natural behavioral patterns to a point where such behavioral patterns would be abandoned or significantly altered.

Sei Whale—The abundance estimate of sei whales in the EEZ of the Hawaiian Islands is 77 (CV = 1.06) within the offshore water habitat. Since there are no density numbers for sei whales, the ratio of the sei whale Hawaiian stock (77) to the fin whale Hawaiian stock (174) was used to calculate the acoustic exposure numbers (77/174=44%). The acoustic effects analysis predicts that RIMPAC training events could result in the exposure of approximately 28 sei whales to accumulated acoustic energy in excess of 173 dB re 1 µPa^2-s. Of these exposure estimates, one would be exposed to accumulated acoustic energy between 195-215 dB re 1 µPa^2-s and 27 between 173-195 dB re 1 µPa^2-s.

It is likely that posted observers would detect sei whales at the surface given their large size (probability of trackline detection = 0.90; Barlow 2003) and pronounced blow. In the rare event that sei whales are present in the proposed RIMPAC areas, any potential behavioral disturbance from exposure to hull mounted mid-frequency active tactical sonar would not be significant. There is little information on the acoustic abilities of sei whales or their response to human activities. The only recorded sounds of sei whales are frequency modulated sweeps in the range of 1.5-3.5 kHz (Thompson et al. 1979; Knowlton et al. 1991) but it is likely that they also vocalized at frequencies below 1 kHz as do fin whales. There are no audiograms of baleen whales but they tend to react to anthropogenic noise below 1 kHz suggesting that they are more sensitive to low frequency sounds (Richardson et al. 1995). Sei whales were more difficult to approach than were fin whales and moved away from boats but were less responsive when feeding (Gunther 1949). Even though any undetected sei whales transiting the proposed RIMPAC ASW training areas may exhibit a reaction when initially exposed to active acoustic energy, field observations indicate the effects would not cause disruption of natural behavioral patterns to a point where such behavioral patterns would be abandoned or significantly altered.

Pinnipeds

Monk Seals—There are approximately 55 monk seals in the main Hawaiian Islands (DoN 2005a). Since there are no density numbers for monk seals, the ratio of the monk seal Hawaiian stock (55) to the fin whale Hawaiian stock (174) or 55/174=32%, was used to calculate the acoustic exposure numbers. Based on input from NMFS, only the acoustic energy above 195 dB re 1 μPa^2-s was evaluated for monk seals. The acoustic effects analysis predicts that RIMPAC training events could result in the exposure of approximately one monk seal to accumulated acoustic energy between 195 to 215 dB re 1 μPa^2-s. However, the majority of the sonar training events will take place in the deep ocean far offshore of the main islands, beyond the primary and secondary occurrence areas for monk seals. Primary occurrence of monk seals in the Main Hawaiian Islands is expected in a continuous band between Kaula Rock, Niihau, and Kauai. This band extends from the shore to around the 500 m isobath. An area of secondary occurrence is expected from the 500 m isobath to the 1,000 m isobath around Kaula Rock, Niihau, and Kauai. A continuous area of secondary occurrence is also expected from the shore to the 1,000 m isobath around the other Main Hawaiian Islands. Given this distribution, and the geographical location of the Proposed Action any potential exposure to the mid-frequency hull-mounted acoustic sources utilized in RIMPAC would not result in a disruption of natural behavioral patterns.

Sea Turtles

Five species of sea turtles could potentially occur within the RIMPAC ASW training areas. All are protected under the ESA. Studies indicate that the auditory capabilities of sea turtles are centered in the low-frequency range (<1 kHz) (Ridgway *et al.* 1969; Lenhardt *et al.* 1983; Bartol *et al.* 1999, Lenhardt 1994, O'Hara and Wilcox 1990). Ridgway *et al.* (1969) concluded that green turtles have a useful hearing span of perhaps 60 Hz to 1,000 Hz, but hear best from about 200 Hz to 700 Hz. These values probably apply to all four of the hard shell turtles (i.e., the green, loggerhead, hawksbill, and olive ridley turtles). No audiometric data are available for the leatherback, but it is likely that leatherbacks do not have the best hearing capability in the mid- and high frequencies.

All this information suggests that sea turtles are likely not capable of hearing mid-frequency (1 kHz–10 kHz) sounds in the range produced by the active tactical sonar used during RIMPAC.

4.3 CUMULATIVE IMPACTS

The 2002 RIMPAC PEA and the 2004 Supplement concluded there would be no cumulative impacts from RIMPAC activities (PEA Section 4.3, pg 4-32; 2004 Supplement Section 4.3, pg 4-7) (Appendix E, 10). The additional activities identified for RIMPAC 2006 include the NEO proposed at PMRF and Niihau. As described in Section 4.1, these activities would result in insignificant impacts. The NEO activities would take place in areas previously identified and used for military training. The activities are short-term, temporary, and do not involve land acquisition, new construction, or expansion of military presence in Hawaii. No other activities have been identified at the proposed locations on PMRF and Niihau that, when combined with the Proposed Action, would result in cumulative impacts.

The new methodology applied for analyzing the potential effects of mid-frequency active tactical sonar from selected RIMPAC training events determined there is a potential for Level B harassment of marine mammals. Level B harassment is defined as an act that disturbs or is likely to disturb to a point where behavior patterns are abandoned or significantly altered. As described above in Section 4.2.1.7, effects to marine mammal species or stocks from RIMPAC ASW training events would be negligible. In addition, Level B harassment is a temporary effect and would not contribute to cumulative impacts.

Therefore, harassment of marine mammals, including endangered sperm, fin, and sei whales, and monk seals, which results from the temporary effects of the proposed RIMPAC ASW training events, would not have any significant contribution to the cumulative effects on marine mammals, including endangered species, when added to other past, present, and reasonably foreseeable future actions. In addition, the protective measures described in Chapter 5, as implemented via the Environmental Annex to the RIMPAC Operation Order (Appendix B), would further reduce any potential for cumulative effects.

Other military activities involving acoustic effects from mid-frequency active tactical sonar within the Hawaiian Islands are currently being evaluated in two additional NEPA documents: the PMRF EIS and the OEIS/EIS for Navy Readiness Activities in the Hawaiian Islands. Quantitative acoustic effect modeling will be applied to ASW operations described in these documents and the potential cumulative effects will be evaluated.

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5.0 PROTECTIVE MEASURES

5.1 PROTECTIVE MEASURES RELATED TO ACOUSTIC EFFECTS

Effective training in the proposed RIMPAC ASW areas dictates that ship, submarine, and aircraft participants utilize their sensors and exercise weapons to their optimum capabilities as required by the mission. The Navy recognizes that such use has the potential to cause behavioral disruption of some marine mammal species in the vicinity of an exercise (as outlined in Chapter 4). This chapter presents the Navy's protective measures, outlining steps that would be implemented to protect marine mammals and Federally listed species during RIMPAC operations. It should be noted that these protective measures have been standard operating procedures for unit level ASW training since 2004 and were implemented for previous RIMPAC exercises; their implementation during RIMPAC 2006 will not be new. This chapter also presents a discussion of other measures that have been considered and rejected because they are either: (1) not feasible; (2) present a safety concern; (3) provide no known or ambiguous protective benefit; or (4) impact the effectiveness of the required ASW training military readiness activity.

5.1.1 Personnel Training

Navy shipboard lookout(s) are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the Officer of the Deck (e.g., trash, a periscope, a marine mammal) and all disturbances (e.g., surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel serving as lookouts on station at all times (day and night) when a ship or surfaced submarine is moving through the water.

Navy lookouts undergo extensive training in order to qualify as a watchstander. This training includes on-the-job instruction under the supervision of an experienced watchstander, followed by completion of the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). In addition to these requirements, many Fleet lookouts periodically undergo a 2-day refresher training course.

The Navy includes marine species awareness as part of its training for its bridge lookout personnel on ships and submarines. Marine species awareness training was updated in 2005 and the additional training materials are now included as required training for Navy lookouts. This training addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information to aid in avoiding interactions with marine species. Marine species awareness and training is reemphasized by the following means:

- **Bridge personnel on ships and submarines—**Personnel utilize marine species awareness training techniques as standard operating procedure, they have available the "whale wheel" identification aid when marine mammals are sighted, and they receive updates to the current marine species awareness training as appropriate.

- **Aviation units—**All pilots and aircrew personnel, whose airborne duties during ASW operations include searching for submarine periscopes, report the presence of marine species in the vicinity of exercise participants.
- **Sonar personnel on ships, submarines, and ASW aircraft—**Both passive and active sonar operators on ships, submarines, and aircraft utilize protective measures relative to their platform. The Environmental Annex to the RIMPAC Operational Order mandates specific actions to be taken if a marine mammal is detected and these actions are standard operating procedure throughout the exercise.

Implementation of these protective measures is a requirement and involves the chain of command with supervision of the activities and consequences for failing to follow orders. Activities undertaken on a Navy vessel or aircraft are highly controlled. Very few actions are undertaken on a Navy vessel or aircraft without oversight by and knowledge of the chain of command. Failure to follow the orders of one's superior in the chain of command can result in disciplinary action.

5.1.2 Operating Procedures

The following procedures are implemented to maximize the ability of operators to recognize instances when marine mammals are close aboard and avoid adverse effects to listed species:

- **Visual detection/ships and submarines—**Ships and surfaced submarines have personnel on lookout with binoculars at all times when the vessel is moving through the water. Standard operating procedure requires these lookouts maintain surveillance of the area visible around their vessel and to report the sighting of any marine species, disturbance to the water's surface, or object (unknown or otherwise) to the Officer in command.
- **Visual detection/aircraft—**Aircraft participating in RIMPAC ASW events will conduct and maintain, whenever possible, surveillance for marine species prior to and during the event. The ability to effectively perform visual searches by participating aircraft crew will be heavily dependent on the primary duties assigned as well as weather, visibility, and sea conditions. Sightings would be immediately reported to ships in the vicinity of the event as appropriate.
- **Passive detection for submarines—**Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASUW/ASW operations involving active mid-frequency sonar. This will include measures for estimating marine mammals close aboard and range using bearings only/bearing rate procedures.

When marine mammals are detected close aboard, all ships, submarines, and aircraft engaged in ASW would reduce mid-frequency active sonar power levels in accordance with the following specific actions:

- When whales or dolphins are detected by any means (aircraft, lookout, or aurally) within 450 yards of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below the equipment's normal operating level for sector search modes. Within the water depths encompassed by the proposed RIMPAC areas, a 6-dB reduction in ping levels would reduce the range of potential acoustic effects to about half of its original distance. This, in turn, would reduce the area of acoustic effects to about one quarter of its original size.

- Ships and submarines would continue to limit maximum ping levels by this 6-dB factor until they assess that the marine mammal is no longer within 450 yards of the sonar dome. Should the marine mammal be detected closing to inside 200 yards of the sonar dome, active sonar transmissions will cease.
- When a marine mammal or sea turtle is detected closing to inside approximately 200 yards of the sonar dome, the principal risk becomes potential physical injury from collision. Accordingly, ships and submarines shall maneuver to avoid collision if the marine species closes within 200 yards to the extent possible, with safety of the vessel being paramount.
- Helicopters shall observe/survey the vicinity of an event location for 10 minutes before deploying active (dipping) sonar in the water. Helicopters shall not dip their sonar within 200 yards of a marine mammal and shall secure pinging if a marine mammal closes within 200 yards after pinging has begun.

The RIMPAC Operational Order Environmental Annex (see Appendix B for an example) includes these specific measures that are to be followed by all exercise participants.

Additionally, the Navy will conduct the following training:

1. Naval Undersea Warfare Center will train observers on marine mammal identification and observation techniques;
2. Third Fleet will brief all participants on marine mammal mitigation procedures and requirements;
3. Navy lookouts will be provided video training on marine mammal awareness; and
4. Navy will offer NOAA/NMFS the opportunity to send a representative to the ashore portion of the exercise to address participants and observe training.

5.1.3 Additional Measures Dismissed from Primary Consideration

As described in Chapter 4, estimated sound exposures to marine mammals during proposed RIMPAC training activities will not cause injury. Potential marine mammal acoustic exposures that may result in harassment and/or a behavioral reaction are further reduced by the protective measures described above. Therefore, the Navy concludes that the Proposed Action and standard protective measures achieve the least practical adverse impact on species or stocks of marine species.

Several additional measures were analyzed and dismissed from primary consideration given unknown, questionable, or limited effectiveness as a protective measure, known or likely detrimental consequences to personnel safety and the effectiveness of the military readiness activity, and based on the practicality of implementation. These measures include:

1. Use of non-Navy personnel onboard Navy vessels to provide surveillance of ASW or other exercise events.

    a. Use of non-Navy observers is not necessary given that Navy lookouts are extensively trained in spotting items at or near the water surface. Navy lookouts receive more hours of training, and utilize their skills more frequently, than many third party-trained personnel.

    b. Use of Navy lookouts is the most effective means to ensure quick and effective communication within the command structure and facilitate implementation of protective measures if marine species are spotted. A critical skill set of effective Navy training is communication. Navy lookouts are trained to act swiftly and decisively to ensure that information is passed to the appropriate supervisory personnel.

    c. Navy and NMFS have not developed the necessary lengthy and detailed procedures that would be required to facilitate the integration of information from non-Navy observers into the command structure.

    d. Some training events during RIMPAC will span one or more 24-hour period with operations underway continuously in that timeframe. It is not feasible to maintain non-Navy surveillance of these operations given the number of non-Navy observers that would be required onboard.

    e. Surface ships having active mid-frequency sonar have limited berthing capacity. Exercise planning includes careful consideration of this limited capacity in the placement of exercise controllers, data collection personnel, and Afloat Training Group personnel on ships involved in the exercise. Inclusion of non-Navy observers onboard these ships would require that in some cases, there would be no additional berthing space for essential Navy personnel required to fully evaluate and efficiently use the training opportunity to accomplish the exercise objectives.

    f. Security clearance issues would have to be overcome to allow non-Navy observers onboard exercise participants.

2. Visual monitoring or surveillance using non-Navy observers from non-military aircraft or vessels to survey before, during, and after exercise events.

    a. Use of non-Navy observers in the air or on civilian vessels compromises security due to the requirement to provide advance notification of specific times/locations of Navy platforms (this information is Classified).

    b. The areas where RIMPAC ASW events will mainly occur (the representative ASW areas modeled) covers approximately 46,000 square nautical miles. Contiguous ASW events may cover many hundreds of square miles. The number of civilian ships and/or aircraft required to monitor the area of these events would be considerable. It is thus, not feasible to survey or monitor the large exercise areas in the time required to ensure these areas are devoid of marine mammals. In addition, marine mammals may move into or out of an area, if surveyed before an event, or an animal could move into an area after an exercise took place. Given that there are no adequate controls to account for these or other possibilities and there are no identified research objectives, there is no utility to performing either a before or an after-the-event survey of an exercise area.

c. Survey during an event raises safety issues with multiple, slow civilian aircraft operating in the same airspace as military aircraft engaged in combat training activities. In addition, most of the training events take place far from land, limiting both the time available for civilian aircraft to be in the exercise area and presenting a concern should aircraft mechanical problems arise.

d. Scheduling civilian vessels or aircraft to coincide with ASW events would impact training effectiveness since exercise event timetables can not be precisely fixed and are instead based on the free-flow development of tactical situations. Waiting for civilian aircraft or vessels to complete surveys, refuel, or be on station would slow the unceasing progress of the exercise and impact the effectiveness of the military readiness activity.

e. The vast majority of RIMPAC training events involve a Navy aerial asset with crews specifically training to hone their detection of objects in the water. The capability of sighting from both surface and aerial platforms provides excellent survey capabilities using the Navy's existing exercise assets.

f. Multiple events may occur simultaneously in areas at opposite ends of the Main Hawaiian Islands and then continue for up to 96 hours. There are not enough qualified third-party personnel to accomplish the monitoring task.

g. There is no identified research design, sampling procedures, or purpose for any survey or monitoring effort.

3. Seasonal, Problematic Complex/Steep Bathymetry, or Habitat Avoidance

a. RIMPAC already takes place in the summer when there is a lower overall density of marine mammals in the Hawaiian Islands.

b. Areas between islands and areas with complex, steep bathymetry generally characterize the majority of the bathymetry in proximity to the volcanic islands forming the Hawaiian Island chain. The implicit assumption of such a measure is that use of active sonar in areas between islands and in areas with complex, steep bathymetry is problematic for marine mammals. There is no evidence to indicate or even suggest these areas are problematic for marine mammal species in the Hawaiian Islands. In addition, it is a requirement that the Navy train to be able to protect vessels moving between islands or landmasses. Avoidance of these areas would eliminate one of the major objectives in the RIMPAC Exercise and thus impact the effectiveness of the training.

c. The habitat requirements for most of the marine mammals in the Hawaiian Islands is unknown. Accordingly, there is no information available on possible alternative exercise locations or environmental factors that would otherwise be less important to marine mammals in the Hawaiian Islands. In addition, exercise locations were very carefully chosen by exercise planners based on training requirements and the ability of ships and submarines to operate safely. Moving the exercise events to alternative locations would impact the effectiveness of the training and has no known utility.

4. Use of active sonar with output levels as low as possible consistent with mission requirements and use of active sonar only when necessary.

    a. Operators of sonar equipment are always cognizant of the environmental variables effecting sound propagation. In this regard the sonar equipment power levels are always set consistent with mission requirements.

    b. Active sonar is only used when required by the mission since it has the potential to alert opposing forces to the sonar platform's presence. Passive sonar and all other sensors are used in concert with active sonar to the maximum extent practical when available and when required by the mission.

5. Suspension of the exercise at night, periods of low visibility, and in high sea-states when marine mammals are not readily visible.

    a. It is imperative that the Navy be able to operate at night, in periods of low visibility, and in high sea-states. The Navy must train as we are expected to fight and adopting this prohibition would eliminate this critical military readiness requirement.

6. Scaling down the exercise to meet core aims.

    a. Training exercises are always constrained by the availability of funding, resources, personnel, and equipment with the result being they are always scaled down to meet only the core requirements.

7. Limit the active sonar event locations.

    a. Areas where events are scheduled to occur are carefully chosen to provide for the safety of operations and to allow for the realistic tactical development of the exercise scenario. Otherwise limiting the exercise to a few areas would adversely impact the effectiveness of the training.

    b. Limiting the exercise areas would concentrate all sonar use, resulting in unnecessarily prolonged and intensive sound levels vice the more transient exposures predicted by the current planning that makes use of multiple exercise areas.

8. Passive Acoustic Monitoring.

    a. As noted in the preceding section, passive detection capabilities are used to the maximum extent practicable consistent with the mission requirements to alert exercise participants to the presence of marine mammals in an event location.

9. Use of ramp-up to attempt to clear an area prior to the conduct of exercises.

    a. Ramp-up procedures involving slowly increasing the sound in the water to necessary levels, have been utilized in other non-DoD activities. Ramp-up procedures are not a viable alternative for training exercises, as the ramp-up would alert opponents to the participants' presence and not allow the Navy to train as they fight, thus adversely impacting the effectiveness of the military readiness activity.

b. Ramp-up for sonar as a protective measure, is also an unproven technique. The implicit assumption is that animals would have an avoidance response to the low-power sonar and would move away from the sound and exercise area, however, there is no data to indicate this assumption is correct. Given there is no data to indicate that this is even minimally effective and because ramp-up would have an impact on the effectiveness of the military readiness activity; it was eliminated from further consideration.

10. Reporting of marine mammal sightings to augment scientific data collection

a. Ships, submarines, aircraft, and personnel engaged in the RIMPAC Exercise are intensively employed throughout the duration of the exercise. Their primary duty is accomplishment of the exercise goals and they should not be burdened with additional duties, unrelated to that task. Any additional workload assigned that is unrelated to their primary duty, would adversely impact the effectiveness of the military readiness activity they are undertaking.

11. Stop the RIMPAC Exercise if there is a marine mammals stranding

a. The Officer in Charge of the Exercise will order cessation of active sonar events in an area where a stranding has occurred and where there is clear and credible available evidence implicating active sonar in the stranding event.

5.1.4 Conservation Measures

The Navy will continue to fund ongoing marine mammal research in the Hawaiian Islands. Results of conservation efforts by the Navy in other locations will also be used to support efforts in the Hawaiian Islands. The Navy is coordinating long term monitoring/studies of marine mammals on various established ranges and operating areas:

- Coordinating with NMFS to conduct surveys within the selected Hawaiian Islands Operating Area as part of a baseline monitoring program.
- Implementing a long-term monitoring program of marine mammal populations in the Hawaiian Islands Operating Area, including evaluation of trends.
- Continuing Navy research and Navy contribution to university/external research to improve the state of the science regarding marine species biology and acoustic effects.
- Sharing data with NMFS and via the literature for research and development efforts.

The Navy has contracted with a consortium of researchers from Duke University, University of North Carolina at Wilmington, University of St. Andrews, and the NMFS Northeast Fisheries Science Center to conduct a pilot study analysis and develop a survey and monitoring plan that lays out the recommended approach for surveys (aerial/shipboard, frequency, spatial extent, etc.) and data analysis (standard line-transect, spatial modeling, etc.) necessary to establish a baseline of protected species distribution and abundance and monitor for changes that might be attributed to ASW operations on the Atlantic Fleet Undersea Warfare Training Range. The Research Design for the project will be utilized in evaluating the potential for implementing similar programs in the Hawaiian Islands ASW operations areas. In addition, a Statement of Interest has been promulgated to initiate a similar research and monitoring project in the Hawaiian Islands and the remainder of the Pacific Fleet OPAREAs. The execution of funding to begin the resultant monitoring is planned for the fall of 2006.

5.1.5 Additional RIMPAC 2006 Protective Measures

Based on discussions between NMFS and Navy, NMFS requested the following mitigation, monitoring, and reporting measures be added to the revised Preliminary Final 2006 Supplement to the 2002 RIMPAC Programmatic Environmental Assessment.

The Navy has requested an Incidental Harassment Authorization (IHA) from NMFS for the take, by harassment, of marine mammals incidental to RIMPAC ASW exercises in the Hawaiian Islands OPAREA. To streamline that process, NMFS agreed to be a cooperating agency on the Navy's RIMPAC 2006 Supplement. Section 101(a)(5)(D) of the MMPA, the section pursuant to which IHAs are issued, may not be used to authorize mortality or serious injury leading to mortality. The Navy's analysis of the RIMPAC ASW exercises concluded that no mortality or serious injury leading to mortality would result from the proposed activities. However, NMFS believes that some marine mammals may react to mid-frequency sonar, at received levels lower than those thought to cause direct physical harm, with behaviors that lead to physiological harm, stranding, or, potentially, death. Therefore, in processing the Navy's IHA request, NMFS has required more mitigation and monitoring than originally proposed in the Navy's application to ensure that mortality or serious injury leading to mortality does not result from the proposed activities.

In any IHA issued, there is the requirement to supply the "means of effecting the least practicable adverse impact upon the affected species." The 2004 NDAA, in addition to redefining Level A and Level B Harassment under the MMPA, indicated that for military readiness activities, NMFS determination of "the least practicable adverse impact on the affected species" would include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of military readiness activities. However, NMFS notes, the extra mitigation and monitoring requirements discussed in the previous paragraph do not have to meet the NDAA standard for "least practicable impact", as they are recommended outside of the scope of an IHA that assumes no mortality. The measures included below are meant to meet the "least practicable adverse impact" standard, but also to ensure that that no mortality or serious injury leading to mortality occurs, so that an IHA may be legally issued under the MMPA.

The protective mitigation and monitoring measures outlined below will be implemented in addition to the standard operating procedures discussed in Section 5.1.1 and 5.1.2, except for the safety zones described in that Section 5.1.2, which have been modified here. Following are the additional measures to be implemented:

1. The Navy will operate sonar at the lowest practicable level, not to exceed 235 dB, except for occasional short periods of time to meet tactical training objectives.

2. Safety Zones - When marine mammals are detected by any means (aircraft, lookout, or aurally) within 1000 m of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below the equipment's normal operating level for sector search modes. Within the water depths encompassed by the proposed RIMPAC areas, a 6-dB reduction in ping levels would reduce the range of potential acoustic effects to about half of its original distance. This, in turn, would reduce the area of acoustic effects to about one quarter of its original size. Ships and submarines would continue to limit maximum ping levels by this 6-dB factor until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 2000 m beyond the location of the sighting.

   Should the marine mammal be detected within or closing to inside 500 m of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level for sector search modes. Ships and submarines would continue to limit maximum ping levels by this 10-dB factor until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 1500 m beyond the location of the sighting.

   Should the marine mammal be detected within or closing to inside 200 m of the sonar dome, active sonar transmissions will cease. When a marine mammal or sea turtle is detected closing to inside approximately 200 m of the sonar dome, the principal risk becomes potential physical injury from collision. Accordingly, ships and submarines shall maneuver to avoid collision if the marine species closes within 200 m to the extent possible, with safety of the vessel being paramount. Sonar will not resume until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 1200 m beyond the location of the sighting.

3. In significant surface ducting conditions, the Navy will enlarge the safety zones such that a 6-dB power-down will occur if a marine mammal enters the zone within a 2000 m radius around the source, a 10-dB power-down will occur if an animal enters the 1000 m zone, and shut down will occur when an animal closes within 500 m of the sound source.

4. In low visibility conditions (i.e., whenever the entire safety zone cannot be effectively monitored due to nighttime, high sea state, or other factors), the Navy will use additional detection measures, such as infrared (IR) or enhanced passive acoustic detection. If detection of marine mammals is not possible out to the prescribed safety zone, the Navy will power down sonar as if marine mammals were present in the zones they cannot see (for example, at night, if night goggles allow detection out to 1000 m, power-down would not be necessary under normal conditions, however, in strong surface duct conditions, the Navy would need to power down 6 dB, as they could not effectively detect mammals out to 2000 m, the prescribed safety zone).

5. With the exception of three specific choke-point exercises (special measures outlined in item 8), the Navy will not conduct active sonar activities in constricted channels or canyon-like areas.

6. With the exception of three specific choke-point exercises (special measures outlined below), and events occurring on range areas managed by PMRF, the Navy will not operate mid-frequency sonar within 13.5 nmi (25 km) of the 110 fathom (200 m) isobath.

7. Navy lookouts, the individuals responsible for detecting marine mammals in the Navy's standard operating procedures, will participate in marine mammal observer training by a NMFS-approved instructor (NMFS will work with Navy to develop appropriate format, potentially to be presented to Navy personnel during the port phase of RIMPAC, June 26-30). Training will focus on identification cues and behaviors that will assist in the detection of marine mammals and the recognition of behaviors potentially indicative of injury or stranding. Training will also include information aiding in the avoidance of marine mammals and the safe navigation of the vessel, as well as species identification review (with a focus on beaked whales and other species likely to strand). At least one individual who has received this training will be present, and on watch, at all times during operation of tactical mid-frequency sonar, on each vessel operating mid-frequency sonar.

8. The Navy will conduct no more than three choke-point exercises. These exercises will occur in the Kaulakahi Channel (between Kauai and Niihau) and the Alenuihaha Channel (between Maui and Hawaii). These exercises will not be conducted in a constricted channel like was present in the Bahamas, but will fall outside of the requirements listed above, i.e., to avoid canyon-like areas and to operate sonar farther than 13.5 nmi (25 km) from the 110 fathom (200 m) isobath. Therefore, NMFS has required additional mitigation and monitoring measures for these three exercises designed to avoid the possibility of mortality, or serious injury leading to mortality, of marine mammals. The additional measures for these three choke-point exercises below are as follows:

    a. The Navy will provide NMFS (Stranding Coordinator and Protected Resources, Headquarters) and the Hawaii marine patrol with information regarding the time and place for the choke-point exercises in advance of the exercises.

    b. The Navy will have at least one dedicated Navy observer that has received the training mentioned above, on board each ship and conducting observations during the operation of mid-frequency tactical sonar during the choke-point exercises. The Navy has also authorized the presence of two experienced marine mammal observers (non-Navy personnel) to embark on Navy ships for observation during the exercise.

    c. The Navy will coordinate a focused monitoring effort around the choke-point exercises, to include pre-exercise monitoring (2 hours), during-exercise monitoring, and post-exercise monitoring (1-2 days). This monitoring effort will include at least one dedicated aircraft or one dedicated vessel for realtime monitoring from the pre- through post-monitoring time period, except at night. The vessel or airplane may be operated by either dedicated Navy personnel, or non-Navy scientists contracted by the Navy., who will be in regular communication with a Tactical Officer with the authority to shut-down, power-down, or delay the start-up of sonar operations. These monitors will communicate with this Officer to ensure the safety zones are clear prior to sonar start-up, to recommend power-down and shut-down during the exercise, and to extensively search for potentially injured or stranding animals in the area and down-current of the area post-exercise.

d. The Navy will further contract an experienced cetacean researchers to conduct systematic aerial reconnaissance surveys and observations before, during, and after the choke-point exercises with the intent of closely examining local populations of marine mammals during the RIMPAC Exercise.

e. For the Kaulakahi Channel (between Kauai and Niihau), shoreline reconnaissance and nearshore observations will be undertaken by a team located at Kekaha (the approximate mid point of the Channel). One of these individuals was formerly employed by NOAA as a marine mammal observer and trained NOAA personnel in marine mammal observation techniques. Additional observations will be made on a daily basis by range vessels while enroute from Port Allen to the range at PMRF (a distance of approximately 16 nmi) and upon their return at the end of each day's activities. Finally, surveillance of the beach shoreline and nearshore waters bounding PMRF will occur randomly around the clock a minimum four times in each 24 hour period.

f. For the Alenuihaha Channel (between Maui and Hawaii), in addition to aerial reconnaissance as described previously, the Navy will undertake shoreline reconnaissance and nearshore observations by a team rotating between Mahukona and Lapakahi before, during, and after the exercise.

9. NMFS and the Navy will continue coordination on the "Communications and Response Protocol for Stranded Marine Mammal Events During Navy Operations in the Pacific Islands Region" that is currently under preparation by NMFS PIRO to facilitate communication during RIMPAC. The Navy will coordinate with the NMFS Stranding Coordinator for any unusual marine mammal behavior, including stranding, beached live or dead cetacean(s), floating marine mammals, or out-of-habitat/milling live cetaceans that may occur at any time during or shortly after RIMPAC activities. After RIMPAC, NMFS and the Navy (CPF) will prepare a coordinated report on the practicality and effectiveness of the protocol that will be provided to Navy/NMFS leadership.

10. The Navy will provide a report to NMFS after the completion of RIMPAC that includes:

    a. An estimate of the number of marine mammals harassed based on both modeled sound and sightings of marine mammals.

    b. An assessment of the effectiveness of the mitigation and monitoring measures with recommendations of how to improve them.

    c. Results of the marine species monitoring during the RIMPAC Exercise.

d. As much unclassified information as the Navy can provide including, but not limited to, where and when sonar was used (including sources not considered in take estimates, such as submarine and aircraft sonars) in relation to any measured received levels (such as at sonobuoys or on PMRF range), source levels, numbers of sources, and frequencies, so it can be coordinated with observed cetacean behaviors.

The mitigation and monitoring proposed in this IHA are intended to function adaptively, and NMFS fully expects to refine them for future authorizations based on the reporting input from the Navy.

6.0 CONSULTATION AND COORDINATION

RIMPAC is a multi-national coordination and communications exercise designed and conducted to ensure that the United States can accomplish shared operational objectives with other nations. As such, RIMPAC is composed of joint, routine ongoing military training events, conducted at the locations where they would normally occur as individual exercises.

Coastal Zone Management

The U.S. Navy has determined that RIMPAC is carried out in a manner that is consistent to the maximum extent practicable with the enforceable policies of Hawaii's Coastal Zone Management Program. Consistent with the Coastal Zone Management Act of 1972, individual training events that would occur as a part of RIMPAC, within U.S. Territorial Waters, have been previously evaluated through preparation and subsequent State of Hawaii review of the RIMPAC 98 EA, RIMPAC 00 EA, RIMPAC PEA, and RIMPAC 04 Supplement. Through the review process the training events have been determined to pose no conflict with the Hawaii Coastal Zone Management Program, Chapter 205A, Hawaii Revised Statutes, or State of Hawaii Coastal Zone Management Polices and approved related resource management programs; or through a prior consistency determination process, the U.S. Navy has taken steps to ensure that these activities are consistent, to the maximum extent practicable, with the approved state management programs referenced above. All training events considered for RIMPAC would be conducted at locations where they are routinely conducted individually, with no change to coastal characteristics or in the potential effect to coastal resources (recreational, historic, scenic and open space, coastal ecosystems, economic uses, coastal hazards, beach areas, and marine resources). All mitigations identified and adopted through a prior consistency determination process would be implemented for RIMPAC.

State Historic Preservation Office Section 106 of the National Historic Preservation Act

Prior consultation has occurred as required by Section 106 of the National Historic Preservation Act and defined in 36 CFR Part 800 of the Advisory Council on the Historic Preservation's regulations, *Protection of Historic Properties*, where required, individually for all ongoing training events that are proposed for RIMPAC. Historic properties and cultural resource sites at all involved locations have been previously identified and the potential effects evaluated. These potential effects of the individual activities would not change when these training events are conducted during RIMPAC. Procedures and mitigations are in place, and sensitive areas have been identified and are avoided. Mitigation measures developed during prior consultations have been adopted; subsequently, no activity conducted as a part of RIMPAC, including the NEO training events proposed at PMRF and Niihau, would present the potential for changes in the character or use of historic properties or cultural resources. Therefore, consistent with 36 CFR 800.4(a)(1) and 800.2(o), the U.S. Navy has determined that RIMPAC does not constitute an undertaking in the sense that no new activities are planned. Instead, it is simply the coordination of ongoing training events that have been previously conducted and would be combined into one exercise for RIMPAC 2006.

In cases of inadvertent discovery of archaeological resources, historic artifacts, or human remains during RIMPAC training events, the particular training event would be halted and the appropriate Cultural Resource Specialist would be contacted and the property or artifact protected in accordance with federal law, regulation, and any existing executed agreements.

Consultation/Coordination with U.S. National Marine Fisheries Service and U.S. Fish and Wildlife Service

MMPA—The new methodology applied for analyzing the potential effects of mid-frequency active tactical sonar from selected RIMPAC training events determined there is a potential for Level B harassment of marine mammals. As described in Section 4.2.1.9, effects to marine mammal species or stocks from RIMPAC ASW training events would be negligible. Due to the fact that the model predicts incidental harassment of marine mammals, the Navy has prepared a Request for Incidental Harassment Authorization for the incidental harassment of marine mammals resulting from the use of hull mounted mid-frequency active tactical sonar in training events conducted during the RIMPAC Exercise. The Navy will coordinate with NMFS during the MMPA permitting process regarding the effectiveness of protective measures and the likelihood that the protective measures will reduce potential acoustic effects on marine mammals.

ESA—Only those RIMPAC training events with the potential to affect a listed species or designated critical habitat or likely to jeopardize proposed species or adversely modify proposed habitat have been the subject of previous consultation with both the NMFS and the USFWS. Where they exist, critical and proposed critical habitats at all involved locations have been previously identified, and the avoidance and monitoring measures normally taken when the training event is conducted individually would be followed during RIMPAC. All previously identified mitigations would be adopted (e.g. approved procedures for the prevention of introduction of alien species, surveys of activity related beach areas for turtles, turtle nesting, and monk seals, determining ocean areas clear of humpback whales prior to training events, etc.)

Based on the RIMPAC ASW acoustic model results, sperm whale, fin whale, sei whale, and monk seal behavioral patterns, results of past RIMPAC Exercises, and the implementation of standard operating procedure protective measures, the Navy finds that the RIMPAC ASW training events may affect sperm whales, fin whales, sei whales, and monk seals. As such the Navy is consulting with NOAA Fisheries under Section 7 of the Endangered Species Act.

All ongoing activities that are conducted in the coastal zone and open ocean areas were the subject of consultation during the establishment of the Hawaiian Islands Humpback Whale National Marine Sanctuary. No further consultation is required for this action. Essential Fish Habitat (EFH) was described in Appendix E of the RIMPAC PEA (Appendix E, 11). Training events conducted during RIMPAC are not expected to adversely affect EFH waters or substrate, therefore no consultation is required.

Copies of previous coordination letters are included in the following pages.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

June 3, 2002

Jeffrey P. Luster, Commander in Chief, U.S. Pacific Fleet (N465)
CPF Environmental Counsel
250 Makalapa Dr.
Pearl Harbor, HI 96860
FAX (808) 474-5494

Re: Rim of the Pacific Exercise (RIMPAC) Programmatic Environmental Assessment (PEA)

Dear CDR Luster:

This responds to your letter (via email) dated May 30, 2002 regarding the Rim of the Pacific Exercise Programmatic Environmental Assessment (RIMPAC PEA). Our comments are provided in accordance with Section 7 of the Endangered Species Act (87 stat. 884 as amended; 16 U.S.C. 1531 et seq.).

The National Marine Fisheries Service (NMFS) has reviewed the PEA and recognizes the prior Section 7 informal consultations addressing the existing military activities covered by the subject PEA. The activities which may affect species under the jurisdiction of NMFS have been previously addressed in the consultation involving the "Report on Military Activities in Hawaiian Waters, April 1995". A comparison review of this document with the current RIMPAC PEA concluded that no significant differences exist.

Following technical discussions, various mitigation measures have been incorporated into the prior approved action to further reduce the likelihood of potential effects to listed species. These measures include:

- Surveying predetermined zones prior to detonation of charges to insure that no protected species are present
- Conducting protected species surveys in the activity area prior to exercises
- Conducting surveys of the activity area following completion of the exercise to identify impacts to protected species
- In the case of amphibious landing exercises, protected species surveys (especially for Hawaiian monk seals) should occur within one hour prior to landing
- NMFS recommends the response plan for seals sighted in landing zones include contacting NMFS Pacific Islands Area Office at (808) 753-0346

Provided the terms and conditions are adhered to during the course of the project activities as stated in the attached section 7 concurrence letter dated September 11, 1995 and the safety zone modeling is implemented for all detonation (which we assume are single charges, not line charges), NMFS concurs with the determination of the Navy that the activities are not likely to adversely affect listed species under the jurisdiction of NMFS. However, any future RIMPAC activities not covered by the PEA may require further section 7 consultation.

If you have any questions regarding this concurrence, please contact Margaret Akamine Dupree of this office at (808) 973-2935 ext 210.

Sincerely,

Rod McInnis
Acting Administrator, Southwest Region

cc: Randy Gallien, Chief, Environmental Policy, Compliance & Remediation
U.S. Army Space & Missile Defense Command, FAX (256)955-5074.

Rebecca Hommon, %RADM Robert T. Conway, Jr., USN Commander, Navy Region Hawaii, FAX (808) 473-2783.

Leona Stevenson, NOAA Fisheries, Southwest Region, FAX (562) 980-4027

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

SEP 11 1995

F/SWO33:ETN

RADM Gordon S. Holder
Commander
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860

Dear RADM Holder:

This is in reference to the Report on Military Activities in Hawaiian Waters (April 21, 1995) and the supplement provided to the National Marine Fisheries Service (NMFS) on August 14, 1995. We have reviewed the subject documents and concur that, based on available information, these activities are not likely to adversely affect humpback whales (Megaptera novaeangliae), Hawaiian monk seals (Monachus schauinslandi), green turtles (Chelonia mydas), hawksbill turtles (Eretmochelys imbricata) or leatherback turtles (Dermochelys coriacea) or designated critical habitat for Hawaiian monk seals, provided the following modifications to operating procedures are included in instructions for the various activities referenced below.

1. All mine warfare and mine countermeasure operations involving the use of explosive charges or live munitions must include safe zones for marine mammals, including humpback whales and sea turtles, that do not result in a take by physical or acoustic harassment. These zones should be calculated for each exercise based on charge type, charge weight, depth of water, and depth of the charge in the water column. Visual surveys by divers in the vicinity of the charge(s) and surveys by small boat(s) should be conducted in order to insure that safe range minimum distances are applied for each exercise. Where applicable and appropriate, acoustic monitoring for marine mammals should also be conducted. A representative from our Protected Species Division is available to assist the Navy in reviewing and/or developing these safe zones.

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Please contact Mr. Eugene T. Nitta at 808-973-2987 or Fax 808-973-2941) should there be any questions concerning these conclusions.

Sincerely,

Hilda Diaz-Soltero

Hilda Diaz-Soltero
Regional Director

cc: F/SW033 - Nitta
CINCPACFLT (N465) - LCDR C. Gaasch

7.0 CONCLUSIONS AND RECOMMENDATIONS

The analyses in this RIMPAC 2006 Supplement conclude that no significant impacts would occur. The Proposed Action and alternatives were compared to the analysis in the RIMPAC PEA. This comparison included a review of the RIMPAC 2006 activities compared to the RIMPAC PEA and the 2004 Supplement. The facilities and procedures for implementing RIMPAC were also reviewed and the affected environment was reviewed to identify any changes. Based on those reviews and the analysis presented in the RIMPAC PEA and 2004 Supplement, no significant impacts to air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, land use, noise, safety and health, socio-economics, or water quality would occur as a result of implementing the Proposed Action or alternatives. In addition, this Supplement includes acoustic effects modeling for hull mounted mid-frequency active tactical sonar completed for RIMPAC 2006. Based on the analysis presented in this supplement and the history of 19 previous RIMPAC exercises where no impacts are known to have occurred, no significant impacts on biological resources would occur as a result of implementing the Proposed Action or alternatives.

The only training event with a change in location is the NEO. Potential impacts from implementing the NEO at PMRF would be insignificant. Procedures for implementing the NEO at PMRF would be similar to the Amphibious Landing Exercise analyzed in the RIMPAC PEA, Section 4.1.1.3, pg 4-3, but the NEO involves fewer people and much less equipment; therefore, the impacts would be insignificant. Within 1 hour prior to initiation of the landing activities, landing routes and beach areas would be determined to be clear of marine mammals and sea turtles. If any are seen, the exercise would be delayed until the animals leave the area.

The NEO activities at Niihau would be similar to Special Warfare Operations training events analyzed in the RIMPAC PEA, Section 4.1.2.1, pg 4-11. Special Warfare Operations training events on Niihau would utilize existing openings, trails, and roads. Helicopter landings would be in areas designated as suitable and absent of biological resources. Therefore, no impacts to biological resources would be anticipated. As stated in the RIMPAC PEA, section 4.1.2.2, pg 4-11, no known traditional cultural properties are located within the U.S. Navy’s Mobile Operations Area on Niihau. Exercise participants would be briefed on the need to promptly notify Navy Region personnel if any cultural resources are found so appropriate coordination could be initiated.

For open ocean areas, an analysis was conducted for RIMPAC 2006, modeling the potential interaction of hull mounted mid-frequency active tactical sonar with marine mammals in the Hawaiian Islands Operating Area. The modeled estimate indicates the potential for a total of 33,331 Level B harassment exposures. Level B harassment in the context of military readiness activities is defined as any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered. This estimate of total predicted marine mammal sound exposures constituting Level B harassment, is presented *without* an assessment of whether those exposures would cause behavioral patterns to be abandoned or significantly altered and *without* consideration of standard protective operating procedures. There are no predicted marine mammal sonar exposures that would result in injury. Based on these results and coordination with NMFS, the Navy has prepared a Request for Incidental Harassment Authorization for the incidental harassment of marine mammals resulting from the use of hull mounted mid-frequency active tactical sonar in training events conducted during the RIMPAC Exercise.

There are no density or abundance figures for blue whales, North Pacific right whales, or minke whales. Minke whales are seasonal in the Hawaiian Islands and should not be present during the summer months when RIMPAC occurs. Like minke whales, the humpback whale is not present in the Hawaiian Islands Operating area in July and therefore was not included in the model.

The sound energy level threshold for determining when an exposure constitutes Level B harassment was determined in consultation with the National Marine Fisheries Service (NMFS) as a cooperating agency. Although Navy believes there is a firm scientific basis for setting this threshold at 190 dB re 1 μPa^2-s Energy Flux Density Level (EL) (see Section 4.2.1 for a full discussion), the use of the 173 decibels (dB) re 1 μPa^2-s EL metric as threshold was required by NMFS as a precautionary measure given this first attempt to quantitatively predict the potential effects of mid-frequency active tactical sonar on marine mammals.

The endangered species that may be affected by the Proposed Action include the North Pacific right whale (*Eubalaena japonica*), the humpback whale (*Megaptera novaeangliae*), the sei whale *(Balaenoptera borealis),* the fin whale (*Balaenoptera physalus*), the blue whale (*Balaenoptera musculus*), the sperm whale (*Physeter macrocephalus),* the Hawaiian monk seal (*Monachus schauinslandi*), the loggerhead sea turtle (*Caretta caretta*), the green sea turtle (*Chelonia mydas),* the hawksbill sea turtle (*Eretmochelys imbricata*), the leatherback sea turtle (*Dermochelys coriacea*), and the olive ridley sea turtle (*Lepidochelys olivacea*). As such the Navy is consulting with National Oceanic and Atmospheric Administration (NOAA) Fisheries under Section 7 of the Endangered Species Act.

Without consideration of protective measures, acoustic effects modeling indicated that up to 34 sperm whales, 3 fin whales, 1 sei whale, and 1 monk seal may be exposed to sonar signals that exceed a Marine Mammal Protection Act (MMPA) Temporary Threshold Shift (TTS) harassment threshold of 195 dB re 1 μPa^2-s EL. Approximately 1,451 sperm whales, 61 fin whales, and 27 sei whales may be exposed to sonar signals above 173 dB re 1 μPa^2-s EL.

As noted previously, modeling was undertaken to assess potential effects by estimating the numbers of marine mammals that could be affected by the activities associated with the use of hull-mounted mid-frequency active tactical sonar during RIMPAC. The results from that modeling do not represent a guarantee of the interaction of sound and mammals since there are factors that will occur relative to the modeled parameters, such as the mitigating effect of standard operating procedures serving as protective measures. These procedures include measures such as decreasing the source level and then shutting down active tactical sonar operations when marine mammals are encountered in the vicinity of a training event. Although these protective measures are standard operating procedure, their use is also reinforced through promulgation of an Environmental Annex to the Operational Orders for the RIMPAC Exercise.

It is likely that Navy ships will detect marine mammals in their vicinity. While conducting the exercise, Navy ships always have two, although usually more, personnel on watch serving as lookouts. In addition to the qualified lookouts, the bridge team is present that at a minimum also includes an Officer of the Deck and one Junior Officer of the Deck whose responsibilities also include observing the waters in the vicinity of the ship. At night, personnel engaged in ASW events may also employ the use of night vision goggles and infra-red detectors, as appropriate, which can also aid in the detection of marine mammals. Passive acoustic detection of vocalizing marine mammals is also used to alert bridge lookouts to the potential presence of marine mammals in the vicinity.

This RIMPAC 2006 Supplement therefore concludes that the Proposed Action and alternatives would result in:

- No significant impacts in accordance with the National Environmental Policy Act (NEPA).
- No significant harm to resources in the global commons under Executive Order (EO) 12114.
- No significant impacts to cultural resources. Consistent with 36 CFR 800.4(a)(1) and 800.2(o), the U.S. Navy has determined that RIMPAC does not constitute an undertaking in the sense that no new activities are planned. Instead, it is simply the coordination of ongoing training events that have been previously conducted and would be combined into one exercise for RIMPAC 2006.
- No destruction or adverse modification of any critical habitat in accordance with the Endangered Species Act (ESA). RIMPAC ASW training events may affect sperm whales, fin whales, sei whales, and monk seals. As such the Navy is consulting with NOAA Fisheries under Section 7 of the ESA.
- A potential for Level B harassment of marine mammals. However, effects to marine mammal species or stocks from RIMPAC ASW training events would be negligible. Due to the fact that the model predicts incidental harassment of marine mammals, the Navy has prepared a Request for Incidental Harassment Authorization for the incidental harassment of marine mammals resulting from the use of hull mounted mid-frequency active tactical sonar in training events conducted during the RIMPAC Exercise.
- No adverse impact to Essential Fish Habitat in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA)
- No conflict with the Hawaii Coastal Zone Management Program, Chapter 205A, Hawaii Revised Statutes, or State of Hawaii Coastal Zone Management Polices and approved related resource management programs; or through a prior consistency determination process, the U.S. Navy has taken steps to ensure that these activities are consistent, to the maximum extent practicable, with the approved state management programs. Consistent with the Coastal Zone Management Act of 1972, individual training events that would occur as a part of RIMPAC within U.S. Territorial Waters,

have been previously evaluated through preparation and subsequent State of Hawaii review of the RIMPAC 98 EA, RIMPAC 00 EA, RIMPAC PEA, and RIMPAC 04 Supplement. Through the review process the training events have been determined to pose no conflict.

Therefore, a finding of no significant impact under NEPA and no significant harm to resources in the global commons under EO 12114 is recommended, to document that further analysis associated with an Environmental Impact Statement or Overseas Environmental Impact Statement is not required.

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APPENDIX A—2002 AND 2004 FINDINGS OF NO SIGNIFICANT IMPACT

FONSI RIMPAC 2002

DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY

FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR THE PROPOSED PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR RIM OF THE PACIFIC (RIMPAC) EXERCISES, HAWAII

Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality regulations, (40 CFR Parts 1500-1508) implementing procedural provisions of NEPA, the Department of the Navy gives notice that a Programmatic Environmental Assessment (PEA) has been prepared and an Environmental Impact Statement (EIS) is not required for the implementation of future RIM OF THE PACIFIC (RIMPAC) exercises, including RIMPAC 2002.

RIMPAC is a multinational, sea control/power projection fleet exercise that has been performed biennially for the last 30 years. The purpose of RIMPAC is to implement a selected set of exercises that is combined into a sea control/power projection fleet training exercise in a multi-threat environment. RIMPAC exercises also demonstrate the ability of a multinational force to communicate and operate in simulated hostile scenarios. RIMPAC 2002 will be the eighteenth in a series involving forces from Australia, Canada and the United States; the twelfth involving the Japanese Maritime Self Defense Force; the seventh involving the Republic of Korea Navy; and the fourth involving the Chilean Navy. The United Kingdom, France and Peru have been accepted to participate in RIMPAC 2002. RIMPAC 2002 is scheduled to be conducted from 25 June to 23 July 2002.

During initial planning meetings in July 2001, the Action proponent, Commander, THIRD Fleet, gathered input from possible participants to understand the various testing and training needs. Operations personnel developed a general scenario to accommodate testing and training needs. As a result of three planning conferences considering budget and time constraints, as well as safety and environmental considerations, a final scenario and set of exercises were developed.

Table 1: RIMPAC Representative Schedule

Activity Average Exercise Days (Expanded Exercise Days)	Total Number of Average Exercise Days	Total Number of Expanded Exercise Days
Multinational Force arrives at Pearl Harbor Day 1 (Days 1-2)	1	2
Multinational Force In Port Briefings Days 1-6 (Days 1-9)	6	9
Bilateral Force Arrives at Pearl Harbor Day 1 (Days 1-2)	1	2
Bilateral Force in-port briefings Days 1-3 and 11-14 (Days 1-5 and 16-21)	7	11
Multinational Force Workup Exercises Days 7-20 (Days 15-36)	14	21
Bilateral Force workup exercises Days 3–10 and 15–20 (Days 5-15 and 22-36)	14	28
Tactical Scenario Exercises Days 20-29 (Days 36-49)	10	14
Amphibious Landing Exercises Days 23 and 29 (Days 34-35 and 45-49)	2	4
Amphibious back-load Days 24 and 30 (Days 35-36 and 49-50)	2	4
Bilateral Force returns to Pearl Harbor Days 29-30 (Days 49-52)	2	4
Multinational Force returns to Pearl Harbor Days 29-30 (Days 49-52)	2	4
Post Exercise Activities Days 30-32 (Days 52-56)	3	5
Dispersal Day 33 (Days 56-57)	1	2

The PEA identifies the Proposed Action as the set of exercises and locations that could be used for future biennial RIMPAC activities for the foreseeable future. The PEA bounds the maximum usage of on-going training assets and exercises that could be conducted within a given RIMPAC and evaluates the impacts on the environment. As long as future RIMPAC exercises do not exceed this maximum, or new locations or exercises are not added, the Proposed Action can be implemented without supplemental NEPA documentation. Thus, the scope of each future RIMPAC exercise will be evaluated for a consistency or non-consistency determination with the PEA and this FONSI.

The Programmatic RIMPAC, including RIMPAC 2002, begins with in-port briefings and preparations for all participants. Table 1 above lists a representative schedule of activities for future RIMPACs. Approximately 60 ships, 10 submarines, 260 aircraft, and 30,000 military personnel for purposes of this PEA were analyzed as the maximum potential RIMPAC activities. Approximately 33 ships, 5 submarines, 52 aircraft, and 10,600 military personnel will be involved in RIMPAC 2002.

Table 2 below lists the Programmatic RIMPAC exercises and locations. The exercises will occur in open-ocean, near shore and onshore environments where they are routinely conducted as individual exercises.

Table 2: Proposed RIMPAC Exercises and Locations

Exercise/Activity	Locations
In-port activities (IN-PORT)*	Pearl Harbor, Oahu*
Command and Control (C2)*	PMRF, Kauai*; Pearl Harbor, Oahu*; Marine Corps Base Hawaii, Oahu*; Hickam Air Force Base, Oahu; Wheeler Army Airfield, Oahu; Bradshaw Army Airfield, Hawaii; Pohakuloa Training Area, Hawaii*; U.S. command ships
Aircraft Operations Support (AIROPS)*	PMRF, Kauai*; Pearl Harbor, Oahu*; Coast Guard Air Station Barbers Point/Kalaeloa Airport, Oahu; Marine Corps Base Hawaii, Oahu*; Hickam Air Force Base, Oahu*; Wheeler Army Airfield, Oahu; Bradshaw Army Airfield, Hawaii*
Surface-to-Air Missile Exercise (SAMEX)*	PMRF, Kauai*; PMRF Warning Areas*
Air-to-Air Missile Exercise (AAMEX)*	PMRF, Kauai*; PMRF Warning Areas*
Air-to-Surface Missile Exercise (ASMEX)*	PMRF Warning Areas*
Surface-to-Surface Missile Exercise (SSMEX)*	PMRF, Kauai*; PMRF Warning Areas*
Anti-Submarine Warfare Exercise (ASWEX)*	PMRF and Oahu Warning Areas*; Open Ocean Areas*
Aerial Mining Exercise (MINEX)*	PMRF Warning Area*
Ship Mine Warfare Exercise (SMWEX)*	PMRF Mine Warfare Training Area*
Strike Warfare Exercise (STWEX), and Close Air Support Exercise (CASEX)*	PMRF, Kauai*; Kaula; PMRF Warning Areas; Pohakuloa Training Area, Hawaii*
Gunnery Exercise (GUNNEX)*	Kaula; PMRF Warning Areas*; Oahu Warning Areas*
Sinking Exercise (SINKEX)*	PMRF Warning Area W-188*
Live Fire Exercise (LFX)	Makua Military Reservation, Oahu; Pohakuloa Training Area, Hawaii
Humanitarian Assistance Operation/Non-combatant Evacuation Operation (HAO/NEO)	Marine Corps Base Hawaii, Oahu; Marine Corps Training Area Bellows / Bellows Air Force Station, Oahu; Kahuku Training Area, Oahu
Humanitarian Assistance/Disaster Relief (HA/DR)	Marine Corps Base Hawaii, Oahu; Marine Corps Training Area Bellows / Bellows Air Force Station, Oahu; Kahuku Training Area, Oahu
Special Warfare Operations (SPECWAROPS)*	PMRF, Kauai (R&S inserts, beach survey)*; PMRF Makaha Ridge (Down Pilot, R&S Inserts)*; PMRF, Port Allen*, Kauai (R&S, boat raid [Staging/Debarkation])*; Niihau (Down Pilot, R&S Inserts); Pearl Harbor/Ford Island (R&S inserts, harbor survey, ship attack; parachute operations, blank firing); Coast Guard Air Station Barbers Point/Kalaeloa Airport, Marine Corps Base Hawaii, Oahu, Hickam Air Force Base, Marine Corps Training Area Bellows / Bellows Air Station, Oahu, Kahuku Training Area, Oahu (R&S inserts); K-Pier, Hawaii, Bradshaw Army Airfield, Hawaii (R&S inserts, helicopter raid); Pohakuloa Training Area, Hawaii (R&S insert, in and outside of impact area); Makua Military Reservation, Oahu (R&S inserts, helicopter raid); Dillingham Military Reservation, Oahu (R&S inserts, snipers); Wheeler Army Airfield (R&S Inserts); Underwater Ranges; Oahu Warning Areas, PMRF Warning Areas; Open Ocean Areas.

Table 2: Proposed RIMPAC Exercises and Locations (Continued)

Exercise/Activity	Locations
Underwater Demolition Exercises (DEMO)*	PMRF and Oahu Warning Areas; Iroquois Land/Underwater Range, Pearl Harbor; Pu'uloa Underwater Range (outside of Pearl Harbor), Oahu*; PMRF, Kauai; Open Ocean Areas; Barbers Point Underwater Range (off-shore of Coast Guard Air Station Barbers Point)
Salvage Operations (SALVAGE OPS)*	Pearl Harbor, Oahu (MDSU-1 staging)*; Pu'uloa Underwater Range, Oahu*; Keehi Lagoon, Oahu*
Amphibious Exercise (AMPHIBEX)*	PMRF, Kauai*; Marine Corps Training Area Bellows/ Bellows Air Force Station, Oahu*; Marine Corps Base Hawaii, Oahu*; K-Pier Kawaihae, Hawaii*
Submarine Operations (SUBOPS)*	PMRF and Oahu Warning Areas*; Open Ocean Areas*
Other Activities*	Transmitter Sites—Niihau, Molokai, Kauai, Oahu, Hawaii
	Boarding Exercises—Open Ocean Areas*

* Exercises and locations proposed for RIMPAC 02
MDSU-1 = U.S. Navy's Mobile Diving and Salvage Unit One
PMRF = Pacific Missile Range Facility

The alternative considered for the Proposed Action was a "no-action" alternative. Under the "no-action" alternative, future RIMPAC exercises would not be conducted. The individual exercises that are a part of existing training activities at the various installations in the Hawaiian Islands would continue. The potential impacts of the "no-action" alternative would be similar to those described for the Proposed Action. Thus, the ability of multinational forces to train, coordinate, and operate in simulated hostile scenarios would be lost, which would adversely impact military readiness. For this reason, the "no-action" alternative was rejected.

The PEA evaluates the potential environmental effects of RIMPAC exercises, location for various exercises including in-port operations, command and control, aircraft operations, ship maneuvers, amphibious landings, troop movements, missile exercises, submarine and antisubmarine exercises, mining and demolition activities, and salvage, special warfare and humanitarian operations.

The PEA addresses all reasonably foreseeable activities in the particular geographical areas affected by the Proposed Action and focuses on the activities with the greatest potential for impacts on the environment. Initial screening determined that because training exercises would take place at existing facilities and ranges routinely used for these types of activities, transportation and utilities would not be impacted and are not included in the PEA. The environmental impact was analyzed for the following resource areas:

Air Quality – Exhaust emissions from targets, missiles and munitions fired from various land, sea and air platforms will be within applicable short-term guideline concentrations and will not significantly affect air quality.

Airspace - Use of rotary and fixed wing aircraft and missiles will be within special use airspace, such as Warning Areas and Restricted airspace. No new special use airspace proposal or any modification to the existing special use airspace is contemplated for the Proposed Action.

Biological Resources - Impacts to biological resources will not be significant. Potential impacts of exhaust emissions on terrestrial and marine biological resources are minimal. Natural Resource Management Plans have been prepared for land ranges to help identify and manage areas with sensitive habitat. Standard Operating Procedures and the RIMPAC Operation Order also include specific requirements for avoiding sensitive habitat areas. Established surveillance procedures will be followed to ensure marine mammals (whales or monk seals) or sea turtles are not present and to report any sightings.

Cultural Resources - Impacts to cultural resources are not anticipated since known sites will be avoided. Integrated Cultural Resource Management Plans and Standard Operating Procedures identify and outline methods for avoiding cultural resource areas. All training exercises are designed to avoid sensitive cultural areas. Ordnance impacts on land are limited to designated impact areas.

Geology and Soils - Potential impacts from missile exhaust emissions, amphibious landings, and the detonations of munitions and charges will not significantly affect the soils.

Hazardous Materials and Waste - No adverse impacts will result from hazardous materials used or hazardous waste generated during RIMPAC. Standard operating procedures for storage and disposal of these materials and wastes will be followed and will not result in any significant impacts.

Land Use - Only minor, temporary impacts will occur from closing various beaches to public use for several hours to accommodate the training requirements of some RIMPAC exercises. These closings are normal, on-going occurrences at the various installations.

Noise - No significant impacts have been identified. Exercise areas are located away from sensitive receptors on existing installation and ranges designated for the proposed noise generating activity.

Safety and Health - Impacts to the health and safety of workers or the public are not expected. Specific safety plans are developed to ensure that each hazardous operation is in compliance with applicable policy and regulations and to ensure that the general public and range personnel and assets are provided an acceptable level of safety.

Socio-economics - RIMPAC exercises are considered to be positive socio-economic impact to the community. The sophisticated urban and tourist infrastructure of the Pearl Harbor and Honolulu area and the depth of experience in accommodating transient military personnel will combine to minimize any adverse impact of RIMPAC on the social infrastructure of the area.

Water Resources - All activities will be carried out in accordance with appropriate instructions and regulations, and the quality of surface and groundwater will not be adversely affected.

Based on the information gathered during preparation of the PEA, the Department of Defense finds that future RIMPAC exercises, including RIMPAC 2002, will not significantly impact the environment and therefore an EIS is not required.

Copies of the PEA and FONSI addressing this action are available by written request to: Commander in Chief, U.S. Pacific Fleet (N465), 251 Makalapa Drive, Pearl Harbor, HI 96860 (ATTN: Ms. Karen Verkennes).

These documents may also be reviewed at the following locations:

Wailuku Public Library
251 High Street
Wailuku, Hawaii 96793
(Maui)
(808) 243-5766

Hilo Public Library
300 Waianuenue Avenue
Hilo, Hawaii 96720
(Hawaii)
(808) 933-8888

Hawaii State Library
Hawaii and Pacific
Section Document Unit
478 South King Street
Honolulu, Hawaii 96813-2901
(Oahu)
(808) 586-3543

Lihue Public Library
4344 Hardy Street
Lihue, Hawaii 96766
(Kauai)
(808) 241-3222

11 June 2002
Date

D. L. CRISP
Deputy Chief of Staff for
Shore Installation Management

FONSI RIMPAC 2004

DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY

FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR RIM OF THE PACIFIC, HAWAII 2002 PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) AND 2004 SUPPLEMENT FOR ADDITIONAL ACTIVITIES

Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, as amended, and the Council on Environmental Quality regulations (40 CFR Parts 1500-1508) implementing the procedural provisions of NEPA, the Department of Defense prepared a 2004 SUPPLEMENT to the RIM OF THE PACIFIC Programmatic Environmental Assessment completed in 2002 (RIMPAC PEA) for RIM OF THE PACIFIC (RIMPAC) exercises, and determined that an Environmental Impact Statement (EIS) is not required for the implementation of the RIMPAC exercises including additional activities proposed for RIMPAC 2004. RIMPAC 2004 is scheduled to be conducted during late June and throughout July, 2004.

RIMPAC has been conducted at various locations throughout the State of Hawaii and surrounding ocean areas biennially for the last 32 years. The purpose of RIMPAC is to implement a selected set of exercises that are combined into a multinational, sea control/power projection Fleet training exercise in a multi-threat environment. RIMPAC exercises enhance the abilities of a multinational Fleet force to communicate and operate in simulated hostile scenarios.

The RIMPAC 2002 PEA identified the Proposed Action as the set of exercises and locations that would be used for RIMPAC activities for the foreseeable future. It identified the maximum usage of ongoing training assets and exercises that could be conducted within a given RIMPAC event and evaluated the impacts on the environment within those bounds. The FONSI for the RIMPAC PEA concluded that as long as future RIMPAC exercises did not exceed the evaluated set of activities, the Proposed Action could be implemented without supplemental NEPA documentation. Thus, the scope of each future RIMPAC exercise would be evaluated for consistency with the 2002 RIMPAC PEA and its FONSI.

During planning meetings beginning in mid-2003, Commander, THIRD Fleet, the Action Proponent, gathered input from possible participants to understand the various participants' training and testing needs. Operations personnel developed a general scenario to accommodate those identified needs. As a result of three planning conferences and taking budgetary and time constraints as well as safety and environmental concerns into consideration, a final scenario and set of exercises were developed for RIMPAC 2004. Although some exercises evaluated in the RIMPAC PEA will not occur or will not be at the highest levels of intensity evaluated, several additional training needs were identified and the resulting additional RIMPAC activities added.

The 2004 SUPPLEMENT was prepared to evaluate the proposed additional RIMPAC activities proposed for 2004 not covered by the RIMPAC PEA. The SUPPLEMENT examined whether new installations or facilities were proposed for use, whether significantly different training levels or types of equipment were proposed, and whether environmental sensitivities had changed. The following table lists the proposed additional RIMPAC exercises and locations evaluated in the 2004 SUPPLEMENT. They constitute Proposed Additional Activities for RIMPAC exercises and when added to the Proposed Action assessed in the PEA form the Proposed Action for purposes of this FONSI.

Proposed Additional RIMPAC Exercises and Locations Evaluated in the 2004 SUPPLEMENT

Exercise/Activities	**Locations**
Gunnery Exercise (GUNNEX)	Pacific Missile Range Facility (PMRF) and Barking Sands Tactical Underwater Range (BARSTUR), Kauai
Mine Countermeasures (MCM)	Marine Corps Training Area Bellows (MCTAB), Oahu; Open Ocean Areas, Hawaiian Islands between Molokai, Lanai and Maui (including Penguin Bank and the U.S. Navy's shallow water training area south of Maui)
Demolition (DEMO)	Land/Underwater Demolition Range, Naval Magazine Pearl Harbor, West Loch Branch (NAVMAG PH West Loch), Oahu; Naval Inactive Ship Maintenance Facility, Middle Loch, Pearl Harbor (NISMF PH), Oahu

The proposed GUNNEX involves artillery firing from land at the PMRF into a simulated target at the existing open-ocean range. No more than 20 rounds would be fired.

Proposed MCM exercises include placing inert mine shapes in waters at MCTAB and open ocean areas off of Molokai, Lanai and Maui and subsequently locating and removing those mine shapes.

Proposed DEMO exercises involve the use no more than 2.5 pounds of explosive materials for training in rendering safe in-water mines and ordnance items, and the salvage and removal of obstacles to clear harbors and water routes. The DEMO exercises would occur at the Demolition Range, Naval Magazine Pearl Harbor, West Loch Branch, Oahu (NAVMAG PH West Loch); and in approximately twenty feet of water at the Naval Inactive Ship Maintenance Facility, Middle Loch, Pearl Harbor (NISMF PH).

Under the "No Action" alternative, the additional activities described above would not be conducted in RIMPAC 2004 and future RIMPAC exercises. Only those exercises analyzed in the RIMPAC PEA would be conducted. The "No Action" alternative would mean that operational forces would have to forego the additional training and multi-national coordination opportunities offered by the proposed additional activities. This would adversely affect military preparedness. For this reason, the "no-action" alternative was rejected.

Initial screening of the additional activities determined that because the training exercises would take place at existing facilities and ranges, transportation and utilities would not be impacted. Therefore, transportation and utilities are not included in the analysis of the 2004 SUPPLEMENT. In addition, the analysis concluded that the proposed additional activities would have no foreseeable impacts on the following resource areas: air quality; geology and soils; hazardous materials and waste; land use; and socio-economics. Environmental impacts were analyzed for the following resource areas:

Airspace - The proposed GUNNEX involving live fire seaward from land-based artillery at PMRF would not impact airspace because the exercise would occur within existing restricted areas and warning areas under the control of PMRF and Fleet Area Control and Surveillance Facility.

Biological Resources - The proposed GUNNEX would have no impact to protected species including marine mammals or sea turtles. The proposed gun emplacement is not located in or near an area designated or proposed as critical habitat nor would the exercise affect or modify any critical habitat. Standard procedures (such as range clearance flights for sea turtles and marine mammals prior to firing; visual inspection of the beach and ocean areas to the front and lateral areas of firing points; and delaying weapons firing until protected species voluntarily leave the area) will be implemented prior to the exercise.

The proposed MCM exercises would have no impact on biological resources because the inert mine shapes will be placed only where the ocean bottom is free of living coral, primarily on sand and rubble bottoms. The inert mines and small boats used to place them in the water will be clean and free of contamination, including potential alien species. Mine placement and removal will be conducted in a manner that would avoid encounters with marine mammals and sea turtles. Mine detection training is conducted with acoustic devices similar to commercial fish locating equipment of low energy and high frequency. Several remotely piloted vehicles would be used which will be recovered following their use.

The proposed DEMO exercises at NISMF PH would involve placement and detonation of underwater charges not to exceed 2.5 pounds at a depth of approximately twenty feet on the hulls of inactive ships within the Middle Loch of Pearl Harbor. No marine mammals or sea turtles are known to inhabit this area; however, clear zones will be maintained. The Waiawa Unit of the Pearl Harbor National Wildlife Sanctuary is approximately 2,360 feet (720 m) from the exercise and will be unaffected by the exercise. Other DEMO exercises would take place on land at an existing range at NAVMAG PH West Loch within existing range explosive limitations.

Cultural Resources - No affects on cultural resources are anticipated. No significant ground disturbing activities are associated with the planned exercises. None of the evaluated activities would take place in an area of known cultural resources. In case of inadvertent discovery of cultural remains during the proposed exercises, the Navy will implement existing plans developed with the appropriate parties.

Noise - The proposed GUNNEX at PMRF would introduce short-term noise impacts associated with the firing of artillery. PMRF will implement appropriate procedures for personnel within the PMRF-controlled areas and will provide appropriate notice to adjacent property users. Adequate hearing protection measures will be implemented within the noise exposure area of concern. Non-participants will not be within that area and may be momentarily disturbed but no affects are anticipated.

Safety and Health - The proposed MCM exercise offshore of MCTAB would not pose a hazard to beach users, body surfers or boaters. The inert mines would be placed at a depth sufficient to avoid affecting small boats transiting within the reef. All the inert mines would be removed at the end of the exercise, eliminating any potential long-term hazard.

No impact to human safety and health is anticipated from the proposed GUNNEX. PMRF Range Safety officials follow established protocols to establish and maintain the safe operation of any Fleet training activity in controlled areas. Human safety and health impacts are not expected on the ocean range into which the expended artillery projectiles will be fired.

The proposed unmanned underwater vehicle is not expected to pose any threats to safety and health.

Water Resources - No adverse impacts on water resources are anticipated. Materials associated with the expended GUNNEX munitions would be rapidly diluted in the open ocean and would not later be found in concentrations that would produce any significant impacts.

The Proposed Action would have no cumulative impacts on these resource areas above. The Proposed Action would not create environmental health and safety risks that may disproportionately affect children and minority or disadvantaged populations. The Navy has conducted an effects test and concluded that the Proposed Action would not have reasonably foreseeable direct or indirect effects on any coastal use or resource of the State's coastal zone.

Based upon a review of the gathered information and the analyses conducted as set forth in the the PEA and the 2004 SUPPLEMENT, the Navy concludes that RIMPAC, including the additional activities proposed for 2004 and subsequent RIMPAC exercises, will not have a significant effect on the human environment and therefore an EIS is not required.

A compact disk of the 2004 SUPPLEMENT and FONSI addressing this Proposed Action is available by written request to: Commander, Pacific Division, Naval Facilities Engineering Command., 258 Makalapa Drive, Suite 100, Pearl Harbor, HI 96860-3134 (Attention: Mr. Andrew Huang, ENV1831).

These documents may also be reviewed at the following locations.

Wailuku Public Library
251 High Street
Wailuku, Hawaii 96793
(Maui)
(808) 243-5766

Hilo Public Library
300 Waianuenue Avenue
Hilo, Hawaii 96720
(Hawaii)
(808) 933-8888

Hawaii State Library
Hawaii and Pacific
Section Document Unit
478 South King Street
Honolulu, Hawaii 96813-2901
(Oahu)
(808) 586-3543

Lihue Public Library
4344 Hardy Street
Lihue, Hawaii 96766
(Kauai)
(808) 241-3222

Date 14 JUN 04

G. A. Engle

G. A. ENGLE
Fleet Civil Engineer

APPENDIX B—RIMPAC 2004 OPERATIONAL ORDER ENVIRONMENTAL ANNEX

ANNEX L TO EXERCISE RIMPAC 2004 OPORDER

ENVIRONMENTAL PROTECTION

References: (a) OPNAVINST 5090.1B, Environmental and Natural Resources Program Manual, CH-4 of June 2003
(b) SOPAPEARLINST 5000.1F, Environmental Protection Guidance
(c) SECNAVINST 5090.7, Access to Ships and Shore Facilities, and Release of information Regarding Navy Oil Spills

1. Responsibilities

a. CTF, BIF and MNF Commanders. Commanders are responsible for ensuring all subordinate units comply with this Annex and applicable environmental laws and regulations. References (a) and (b) detail United States Navy and Pearl Harbor environmental compliance requirements. Applicable portions related to ships participating in RIMPAC 2004 are provided in Appendices 1 and 2 of this Annex as well as online through the RIMPAC website.

b. Commanding Officers of Units.

(1) Commanding officers will comply, to the fullest extent practicable, with the preventive measures outlined in this annex to prevent harm to marine mammals. Where a specific preventive measure is impracticable, due to resource availability, asset allocation, or other basis, the exercise may proceed if the specific preventive measure can be complied with by alternative means sufficient to ensure minimal impact to the marine environment that the measure was designed to protect.

(2) Commanding Officers will cooperate with Federal, State and local government authorities in the prevention, control and abatement of environmental pollution as required by reference (c). If requirements of an environmental law or regulation cannot be achieved for any reason, including operational considerations or insufficient resources, the Commanding Officer will report to the immediate superior in the chain of command and Commander, THIRD Fleet as well as Commander Navy Region (COMNAVREG) Hawaii.

(3) Commanding Officers will be aware of all regulations regarding pollution control in the vicinity of the Hawaiian Islands, and recommend remedial measures when appropriate.

(4) Commanding Officers will seek assistance from Commander THIRD Fleet and the Regional Environmental Coordinator, COMNAVREG Hawaii as needed to ensure environmental compliance.

c. Regional Environmental Coordinator (REC). The REC for the Hawaiian Islands, COMNAVREG Hawaii, can be reached at commercial (808) 471-1171 ext 229 (for commercial and DSN), FAX (808) 471-1160.

(1) The REC will assist Commanders and Commanding Officers in environmental compliance.

(2) The REC will conduct oil spill notification and response exercises.

(3) The Deputy Navy On-Scene Coordinator (NOSC) will operate the COMNAVREG Hawaii oil spill hotline at (808)473-4689 or during off-duty hours at (808) 864-2463 (cell).

2. Environmental Compliance for Afloat Units

a. Discharge Restrictions at Sea.

(1) A summary of discharge restrictions is contained in Appendix 1 of this Annex, summarized from Chapter 19 of reference (a). Immediately contact Commander, THIRD Fleet and the COMNAVREG Hawaii environmental counsel at (808) 473-4731 for guidance if any difficulty is experienced in complying with these restrictions.

(2) In addition to the restrictions in Appendix 1, vessels should avoid discharging any substance listed in Appendix 1 while operating within the 100-fathom [600-foot (ft) or 183-meter (m)] isobaths in the areas between the islands of Maui, Molokai, Lanai, and Kahoolawe.

b. Disposal in Port. All requests for disposal of wastes from ships should be included in LOGREQs. Appendix 2 of this Annex is the applicable portion of the Commander, U.S. Pacific Fleet, Senior Officer Present Afloat Pearl Harbor Instruction for disposal of wastes by ships while in Pearl Harbor.

3. Underwater Explosives

a. Endangered/threatened marine species, including the humpback whale, Hawaiian monk seal, green sea turtle, hawksbill sea turtle, and leatherback sea turtle, are present in the waters and along the shorelines of the Hawaiian Islands. To ensure protection of these animals, all shoreline and water areas, which may be affected by the detonation of explosive charges or the use of explosive munitions, must be determined to be clear of protected marine species prior to detonation or discharge. Commands planning or sponsoring any type of underwater detonations must include COMNAVREG Hawaii N00L as an info addressee on all requests for underwater detonations.

b. All mine warfare and mine countermeasure operations involving the use of explosive charges must include safe zones for marine mammals (including humpback whales) and sea turtles to prevent physical and/or acoustic harm to those species.

(1) For DEMO, pre-exercise survey shall be conducted within 30 minutes prior to the commencement of the scheduled explosive event. Appendix 4 to this Annex provides information on areas to be cleared with respect to explosive charge weights.

(2) The survey may be conducted from the surface, by divers, and/or from the air, and personnel shall be alert to the presence of any marine mammal or sea turtle. Should such an animal be present within the survey area, the exercise shall be paused until the animal voluntarily leaves the area.

(3) Surveys within the same radius shall also be conducted within 30 minutes after the completion of the explosive event.

(4) Pre- and post-exercise surveys shall be reported to the Commander THIRD Fleet Judge Advocate and the COMNAVREG Hawaii environmental counsel at (808) 473-4731. Negative reports for post operations surveys are required. Any evidence of a marine mammal or sea turtle that may have been injured or killed by the action shall be reported immediately in accordance with procedures listed in Section 4.e(2) (that are applicable) of this document.

4. Ships/Aircraft Under Way. Prudent actions can reduce the risk of damage to ships, reduce the chances for injury to other marine mammals in the vicinity, and assist in future risk management analysis.

a. By law, no ship is to approach within 300 ft (90 m) of a humpback whale, and no any aircraft is to operate within 1,000 ft (300 m) or less of a humpback whale. Humpbacks are naturally inquisitive and historically have initiated close encounters despite best efforts to avoid them. Naval operations in the waters of the Hawaiian Islands Humpback Whale National Marine Sanctuary are authorized based in part on the Navy's practice of taking all reasonable precautions to avoid collisions with these endangered animals.

b. Ensure observers are briefed on the possible presence of marine mammals and that all sightings are reported to the bridge. Whales often travel in groups and a sighting indicates the possibility of others in the vicinity.

c. Upon sighting a whale, adjust course and speed as necessary to maintain a safe distance from the whales consistent with prudent seamanship.

d. Sightings of all whales shall be passed to other ships in the area to alert them to the possibility of the whales' presence.

e. In the event of a collision, if possible, take video and/or photographs of the stricken whale.

(1) Attempt to identify distinguishing characteristics of the whale involved. The "whale wheel," a device that lists various species of whales and their identifying features, can assist in this regard.

(2) Report all whale strikes via Unit SITREP or OPREP as appropriate. Whale strike report guidance and format is located in Annex L, Appendix 3, paragraph 2.

5. Gunnery Exercises (GUNNEX) Affecting Marine Environment

a. Non-explosive munitions:

(1) Establish a 600-ft (183-m) radius buffer zone around the intended target.

(2) From the intended firing position, use observer(s) to survey for marine mammals and sea turtles in and around the buffer zone prior to commencement and during the exercise as long as practicable.

(3) Exercise shall be conducted only when the buffer zone is visible and the area is visibly clear of marine mammals and sea turtles.

(4) Commence and continue exercise only if marine mammals and sea turtles are not detected within the buffer zone.

b. Explosive munitions, Land Firing Points:

(1) Adhere to specific procedures and regulations of the range and the requirements of this Appendix. For example, the PMRF Range Safety Officer requires that any weapon fired on any PMRF range have a Range Safety Approval or a Range Safety Operational Plan. The Exercise Program Manager and Operations Conductor must provide all range users a safety brief prior to any exercise. For live fire with 155-mm howitzer, in addition to protecting marine environment, temporary evacuation or appropriate hearing protection is required for all non-participants on PMRF within the impacted area as delineated by the 140-dBP noise contour/arc. Non-participants within the 140 dBP zone shall either (a) be inside buildings having closed, non-jalousie type windows and wear ear plug hearing protection devices providing a noise reduction rating (NRR) of at least 20 dB or (b)if outside or in buildings with jalousie type windows or with open windows, wear hearing protection providing a NRR of at least 35 dB. Consult with Range Safety Officer for details.

(2) Conduct range clearance flight within one hour prior to any weapons being fired into the offshore ranges at PMRF to search visually for vessels, marine mammals, and sea turtles. For live fire with 155-mm howitzer, establish a 2.5-mile [4.0-kilometer (km)] radius buffer zone (to be cleared) around the intended target area.

(3) Within 30 minutes prior to the commencement of the firing exercise, conduct an inspection of the beach and water areas from the firing line to the horizon, directly in front of the firing line and laterally to 15 degrees on either side. If any marine mammals or sea turtles are observed in the clearance areas, firing will not commence until the animals voluntarily leave the area.

(4) Restrict entry of motorists and other members of the public into off-station areas impacted by the 140 dBP noise contour for the duration of the firing. Make an inspection of the beach areas within the 140 dBP zone, to ensure the area is clear of personnel. Secure the beach at either end of the 140 dBP zone to ensure the area remains clear for the duration of firing.

(5) Commence and continue exercise only if marine mammals and sea turtles are not detected within the buffer zone.

(6) Commence post-exercise surveys of the buffer areas within 30 minutes after completion of the firing.

(7) Pre- and post-exercise surveys shall be reported to the chain-of-command with copies to NAVFAC EFD Pacific ENV1832 at (808) 474-5923 and COMNAVREG Hawaii N465 at (808) 471-1171 ×233. Negative reports for post operations surveys are required. Report any injured marine mammals and sea turtles to the Commander THIRD Fleet Judge Advocate and the COMNAVREG Hawaii environmental counsel at (808) 473-4731.

6. Practice bombing (explosive and non-explosive)

a. Establish a buffer zone around the intended target zone. See Appendix 4 to this Annex for information. In the future should similar information be required for other exercises or training evolutions not covered in Appendix 4, SPAWAR should be contacted at (619) 553-0021 for assistance. For SINKEX, a buffer zone with a 2.9 miles (4.6 km) radius around the intended target is required to be clear of non-exercise vessels, marine mammals, and sea turtles.

b. Visually survey the buffer zone for marine mammals and sea turtles one hour prior to and post (as safety allows) the exercise.

c. Visual survey to be conducted at an altitude of 1,500 ft (500 m) or lower to accomplish clearance survey of the impact area, if safe to do so, and at the slowest safe speed.

d. Survey aircraft should employ most effective search tactics and capabilities to increase the probability that marine mammals and sea turtles will be detected.

e. Conduct exercise only if the buffer zone is clear of marine mammals and sea turtles.

f. Do not release ordnance through cloud cover. Aircraft must be able to actually see ordnance impact areas.

7. Mine Countermeasures (mine hunting/mine sweeping/bottom mapping and survey/emplacement and retrieval of shallow water mines in littoral areas [e.g., Marine Corps Training Area Bellows (MCTAB)])

a. During small boat operations, note the presence of sea turtles and marine mammals.

b. Craft and personnel shall avoid direct contact with any marine mammal, sea turtle, or living coral.

c. Mine shapes shall be emplaced only on sand/rubble bottoms not having living coral reef development and where placement or removal or the shapes would not adversely impact adjacent living corals. See paragraph 11.c for additional information.

d. At MCTAB, mine shapes shall not be placed in water of a depth less than 10 feet (9 m) MLLW, nor closer to shore than 300 ft (91 m). The top of the mine shape shall be a minimum of 7 ft (2.1 m) below MLLW.

8. Hull-mounted surface and submarine active sonar.

a. Avoid critical habitats, marine sanctuaries, and the Humpback Whale Sanctuary (see Annex A to Appendix L-3 in OPORDER).

b. Surface vessels only: Use observers to visually survey for and avoid operating active sonar when sea turtles and/or marine mammals are observed.

c. Submarines and surface units: Monitor acoustic detection devices for indications of close aboard marine mammals (high bearing rate biologic contacts). When a surface combatant or a submarine conducting active sonar training detects a marine mammal close aboard, reduce maximum sonar transmission level to avoid harassment in accordance with the following specific actions.

(1) When marine mammals are detected by any means (aircraft, observer, or aurally) within 600 ft (183 m) of the sonar dome, the ship or submarine will limit active transmission levels to at least 4 dB below their equipment maximum for sector search modes.

(2) Ship and submarines will continue to limit maximum transmission levels by this 4 dB factor until they determine the marine mammal is no longer within 600 ft (183 m) of the sonar dome.

(3) Should the marine mammal be detected closing to inside 300 ft (92 m) of the sonar dome, the principal risk to the mammal changes from acoustic harassment to one of potential physical injury from collision. Accordingly, ships and submarines shall maneuver to avoid collision. Standard whale strike avoidance procedures apply.

(4) When seals are detected by any means within 1,050 ft (320 m) of the sonar dome, the ship or submarine shall limit active transmission levels to at least 4 dB below equipment maximum for sector search mode. Ships or submarines shall continue to limit maximum ping levels by this 4 dB factor until the ships and submarines determine that the seal is no longer within 1,050 ft (320 m) of the sonar dome.

(5) Special condition applicable for dolphins only. If after conducting an initial maneuver to avoid close quarters with dolphins, the ship or submarine concludes that dolphins are deliberately closing on the ship to ride the vessel's bow wave, no further mitigation actions are necessary. Note that while in the shallow, wave area of the vessel bow, dolphins are out of the main transmission axis of the mainframe active sonar and only exposed to significantly lower power levels.

9. Helo dipping sonar-training operations

a. Helos shall observe/survey the intended exercise area for marine mammals and sea turtles for a 10-minute duration before dipping active sonar transducer in the water.

b. Helos shall not dip their active sonar transducer within 600 ft (183 m) of a marine mammal or sea turtle.

c. If a marine mammal or sea turtle is detected while the helo has its sonar dipped and pinging, secure pinging if the marine mammal/sea turtle is located closing inside of 150 ft (46 m).

10. Invasive Species

a. Introduction of any plant or animal into Hawaii without permission of the Hawaii State Department of Agriculture is prohibited. Commanding Officers of all vessels shall, prior to arrival in Hawaii, ensure that all stores originating from Australia and Guam are inspected for the brown tree snake. This inspection may be accomplished during on-loading of such stores or while underway. Inspection records may be provided upon arrival in Hawaii to Department of Agriculture inspectors, who will inspect ships at berth for compliance with State animal quarantine laws. This inspection will not interfere with the granting of liberty.

b. Post-arrival action. If a snake is sighted aboard ship, aircraft, or during training exercises on land, restrain, contain, or kill the snake until appropriate authorities arrive. Immediately notify NAVSTA Pearl Harbor Security Police of all snake sightings at (808)471-7114 (24 hours).

c. For information regarding snakes, contact COMNAVREG Hawaii N465 at (808) 471-1171 x233.

d. Ensure all equipment and unmanned vehicles to be placed in ocean areas are clean and free from residual materials and invasive species from prior use (e.g., shapes, Seaglider, REMUS/BPAUV, etc.).

11. Coral Reef Protection

a. The United States has taken a number of steps in response to international concerns about coral reefs. One such measure was the establishment of the North-Western Hawaiian Islands Coral Reef Ecosystem Reserve (Reserve), by Executive Order 13178. The coverages are as follows:

(1) From the seaward boundary of Hawaii State waters and submerged lands to a mean depth of 600 ft (183 m) around:

(a) Nihoa Island;
(b) Necker Island;
(c) French Frigate Shoals;

(d) Gardner Pinnacles;
(e) Maro Reef;
(f) Laysan Island;
(g) Lisianski Island;
(h) Pearl and Hermes Atoll; and
(i) Kure Island.

(2) 13.8 miles (22.2 km) round the approximate geographical centers of:

(a) The first bank immediately east of French Frigate Shoals;

(b) Southeast Brooks Bank, which is the first bank immediately west of French Frigate Shoals, provided that the closure area shall not be closer than approximately 3.5 miles (5.6 km) of the next bank immediately west;

(c) St. Rogatien Bank, provided that the closure area shall not be closer than approximately 3.5 miles (5.6 km) of the next bank immediately east;

(d) The first bank west of St. Rogatien Bank, east of Gardner Pinnacles;

(e) Raita Bank; and

(f) Pioneer Bank.

b. The following activities are prohibited within the Reserve:

(1) Discharging or depositing any material or other matter into the Reserve, or discharging or depositing any material or other matter outside the Reserve that subsequently enters the Reserve and injures any resource of the Reserve except for discharges incidental to vessel use such as deck wash, approved marine sanitation device effluent, cooling water, and engine exhaust;

(2) Removal, moving, taking, harvesting, or damaging any living or nonliving Reserve resources;

(3) Any type of touching or taking of living or dead coral; and

(4) Having a vessel anchored on any living or dead coral with an anchor, an anchor chain, or an anchor rope when visibility is such that the seabed can be seen.

c. Protective Measures to Safeguard Corals Located Outside the Reserve. The following measures should be adhered to:

(1) Any amphibious assault or similar training activities) shall be limited to marked channels that avoid near-surface corals, where such corals may be impacted by the type of amphibious vehicle contemplated for use.

(2) Inert mines shall not be placed on living coral.

(3) The exceptions to these prohibited activities are as follows:
(a) An emergency poses an unacceptable threat to human health or safety or to the marine environment and admitting of no other feasible solution; or

(b) In any case that constitutes a danger to human life or a real threat to vessels, aircraft, platforms, or other man-made structures at sea, such as extreme weather conditions or similar significant natural events.

12. Sea Turtles and Hawaiian Monk Seals On Beaches. Amphibious landings at MCTAB and PMRF shall adhere to all guidance regarding protection of sea turtles and Hawaiian monk seals on the beach relative to those areas. Mitigation measures shall be instituted to assure minimal impacts to these species. Specifically, prior to conducting a landing exercise, an inspection and survey protocol will include:

a. Within one hour prior to the commencement of an amphibious landing exercise, observer(s) shall survey affected beaches for sea turtles, sea turtle nesting sites, and Hawaiian monk seals. Sea turtle nesting sites shall be marked and no trespassing by persons or vehicles within 50 ft (15 m) of the nest shall be allowed.

b. Should sea turtles or Hawaiian monk seals be found on the beach, the landing shall be

(1) (1)delayed until the animal(s) have voluntarily left the area; or

(2) (2)moved to another location free of such animals.

c. Landing craft and AAV crews shall be made aware of the potential presence of these endangered and threatened species.

13. Inadvertent Discovery of Cultural Resources. Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of undertakings on historic properties. Section 110 of the Act requires federal agencies to establish a program of identification, evaluation and protection of historic properties under their control. Military installations in Hawaii have complied with Sections 106 and 110 by consulting on individual undertakings or programs or by executing programmatic agreements on their operations. Installations have also developed integrated cultural resources management plans that identify historic properties and establish standard operating procedures regarding treatment of historic properties and discoveries during a military action. Installation cultural resources specialists or managers are cognizant of who should be consulted for compliance under Section 106.

Discovery Plan: In the event that archaeological resources, historic artifacts, or human remains are discovered during RIMPAC exercises, the following procedures must be followed:

a. Halt all activities in the area immediately. Protect the resource from further damage and from the weather.

b. Notify Range Control of the find and any damage caused.

c. Range Control will contact the appropriate Environmental Office/Department Cultural Resource Specialist or Manager:

-Puhakuloa Training Area – (808) 969-3340 (from the Island of Hawaii) or (808) 523-5196 (from the Island of Oahu);
-Other Army ranges on Oahu – (808) 656-6821 ext 1052;
-Marine Corps Base Hawaii Kaneohe Bay and the Marine Corps Training Area Bellows – (808) 257-6920 ext 254;
-Navy ranges – (808) 471-1171 ext 233; and
-Hickam Air Force Base Hawaii – (808) 449-1584 ext 245.

d. The notified Cultural Resource Specialist or Manager will implement discovery procedures established under an executed agreement document.

e. If no agreement document exists for the installation, carry out the following procedures:

-The installation's Cultural Resource Specialist/Manager will assess the discovery, collect sufficient information to evaluate its significance and National Register eligibility, record the discovery by identifying its location through global positioning system (GPS), photography, and site mapping.
-If discovery includes human remains and associated cultural items, follow procedures in accordance with 43 CFR Part 10, implementing regulations of Native American Graves Protection and Repatriation Act.
-If discovery is an archaeological resource deemed eligible for the National Register, the installation will determine actions to be taken to resolve the adverse effects and notify the Hawaii State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), and Office of Hawaiian Affairs (OHA) within 48 hours of the discovery.
-The installation will consider recommendations received from consulted parties and then carry out the appropriate actions.
-When the actions are completed, the installation will provide a report to SHPO, ACHP, and OHA.

14. APPENDICES:

(1) Summary of Discharge Restrictions
(2) Annex P of SOPAPEARL 5000.1F (Environmental Protection Guidance)
(3) Marine Mammals/Endangered Species Protection
(4) Underwater Explosion Effects Table
(5) Environmental Protection Measures Summary Matrix

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APPENDIX C—ACOUSTIC MODELING RESULTS

INTRODUCTION

Naval Undersea Warfare Center Division Newport has completed modeling of the potential interaction of the mid-frequency active sonars with marine mammals in the Hawaiian Islands Operation Area for Rim of the Pacific exercise in 2006 (RIMPAC 2006). RIMPAC is a multinational training event. Pursuant to the National Environmental Policy Act and the Marine Mammal Protection Act (MMPA), the Navy is required to assess effects of sonar operations to estimate the numbers of marine mammals that could be affected by these activities. This document describes the input data used and the analysis method employed to estimate the number of marine mammals that could be affected by operation of Navy tactical sonar systems during RIMPAC events using mid-frequency active sonar. The input data key to this methodology falls into the following categories:

- Marine mammal density estimates for the proposed event locations
- Definitions for Level A and Level B harassment thresholds for military readiness activities
- Geophysical data for the sites
- Characterization of Navy training scenarios and the military sonars to be used
- Operational characteristics for the sonar systems to be used (many of these parameters are classified)

Information on marine mammal density estimates is a summary obtained from Barlow (2003), Mobley (2000) and the Hawaiian Island Operation Area Marine Resource Assessment (Navy 2005). Geophysical/oceanographic data was compiled by NUWC from multiple sources. Chief of Naval Operations Environmental Readiness Division (CNO N45) along with the National Marine Fisheries Service (NMFS) defined marine mammal harassment criteria, Level A and Level B harassment thresholds as cooperating agencies in the development of the Draft *Overseas Environmental Impact Statement/Environmental Impact Statement, Undersea Warfare Training Range* (OEIS/EIS) (USWTR; Navy 2005). A discussion of these thresholds appears in the USWTR OEIS/EIS (Navy 2005). In subsequent discussions with NMFS, the threshold criteria for Level B has been modified to the levels described in Section 4 of this Supplement explaining Level A and Level B sonar criteria and thresholds for cetaceans and how they were derived.

The training events modeled capture the full scope of activities expected to occur during RIMPAC 2006. Sound source operational characteristics were collated by NUWC and Pacific Fleet command, exercise planners, and the technical warfare publications. US Navy sonar characteristics were used to represent all proposed active sonars including foreign platforms. All unclassified input data is summarized in this document.

The remainder of this report describes how the analysis was conducted. The model calculates an area for which each source produces a total energy flux (also referred to as total acoustic energy or total energy flux density) above the defined Level A and Level B harassment thresholds. This is calculated for all proposed sonar sources for each period of training for six representative operational locations. This derived surface area is multiplied by the appropriate mammal population density for each species to determine the estimated number of harassments that will occur during each training event. A summary of the input data for the methodology is provided in Figure C-1 and a flow chart for the modeling is shown in Figure C-2.

The final results are described as the 'estimated number of harassments'. These results depend on the input data values for each of the categories described above. Each category has a varying degree of confidence and stability with time. The results also depend on definitions made for the methodology that bound the volume of analysis. Without these constraints, the number of variations that could be modeled would be near infinite. The use of defined ship tracks, specific acoustic propagation analysis points, representative training scenarios and typical source characteristics are all examples of these constraints. The goal was an unbiased modeled prediction of the number of harassments that are expected over time given these diverse and variable factors; the results represent the average that would be expected given the input parameters. The results do not represent an absolute guarantee of the interaction of sound and mammals since variations can occur relative to the modeled parameters.

Most importantly, the modeling does not factor in the mitigating effect of standard operating procedures serving as protective measures. These procedures include measures such as decreasing the source level and then shutting down active sonar operations when marine mammals are encountered in the vicinity of a training event and thus, greatly reduce the potential to affect a marine mammal as a result of active sonar training during RIMPAC.

Categories of Input Data

Acoustic Environment

For each Area
- Seasonal SSPs
- Seabed Geo- acoustics
- Wind speed & wave height
- Bathymetry

Navy Training Requirements & Acoustic Source Data

Description of Training Scenarios
- Sources used
- Frequency & duration of training
- System duty cycles

Active Sonar Characteristics
- Source level
- Frequency
- Pulse length
- Repetition rate
- Platform speed
- Beampatterns

Marine Mammal Population

For each Area
- Determine species for inclusion in the analysis
- Establish marine mammal density for each species

Acoustic Impact Definitions

Determine
- Criteria Definitions for Level A and Level B Harassment for All Species

Figure C-1 Summary of Input Data Used in Analysis

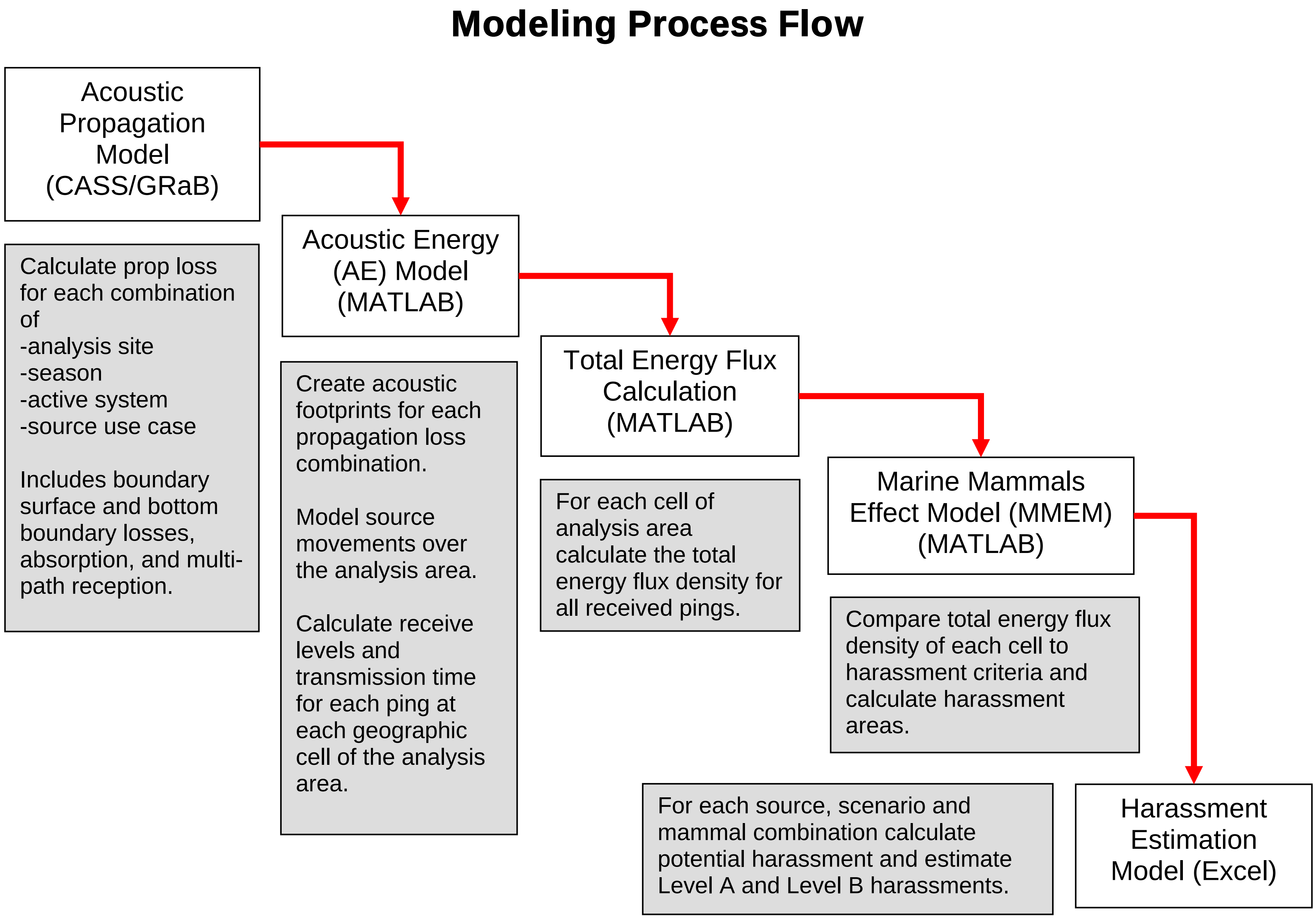


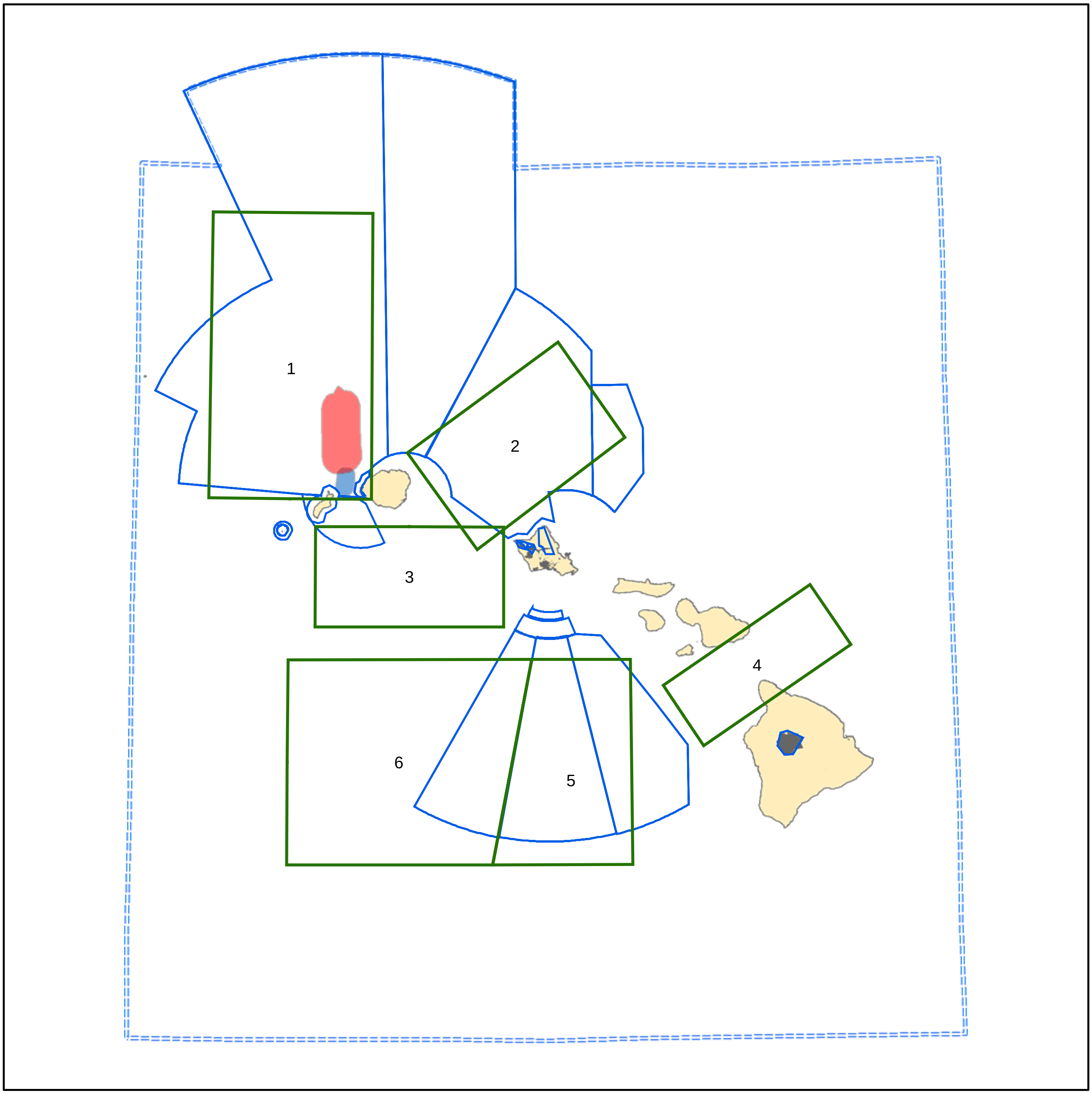
Figure C-2 Summary of Modeling Steps, Models and Software Platforms Used

SITE DESCRIPTION

There were six representative areas modeled for analysis of all RIMPAC 2006 as shown in Figure C-3. The location of each representative area is listed in Table C-1.

Table C-1 RIMPAC 06 Sonar Exercise Analysis Boundaries

	Latitude	**Longitude**		**Latitude**	**Longitude**
Area 1			**Area 2**		
	24°34'36"N	161°16'43"W		22°22'53"N	159°19'26"W
	24°34'36"N	159°40'36"W		23°23'37"N	157°49'46"W
	21°57'6"N	159°40'36"W		22°30'49"N	157°10'36"W
	21°57'6"N	161°16'43"W		21°29'37"N	158°38'4"W
Area 3			**Area 4**		
	21°41'53"N	158°22'40W		20°14'3"N	156°49'53"W
	20°46'48"N	158°22'40W		21°8'2"N	155°22'47W
	20°46'48"N	160°13'23"W		20°34'31"N	154°59'47"W
	21°41'53"N	160°13'23"W		19°40'29N	156°26'42"W
Area 5			**Area 6**		
	20°28'43"N	158°5'55"W		20°28'43"N	160°28'12"W
	20°28'43"N	157°8'8"W		20°28'43"N	158°5'55"W
	18°35'44"N	157°8'8"W		18°35'44"N	158°29'W
	18°35'44"N	158°29'W		18°35'44"N	160°28'12"W



Explanation

- RIMPAC ASW Acoustic Effect Modeling Areas
- Hawaiian Islands Operating Area
- Special Use Airspace
- BSURE Hydrophones
- BARSTUR Hydrophones
- Military
- Land Area

North

0 50 100 200 Nautical Miles

RIMPAC ASW Acoustic Exposure Modeling Areas

Hawaiian Islands

Figure C-3

DISTRIBUTION AND ABUNDANCE OF MARINE MAMMALS

One important aspect in the evaluation of potential effects to marine mammals in any given area is an understanding of the distribution and abundance of the mammals within that geographic area. For purposes of this modeling effort, the density estimates contained in Table C-2 were used.

The density estimates are spatially different. The Mobley densities are applicable for areas within 25 nmi of land and the densities from Barlow are appropriate for areas beyond 25 nmi. To determine how to use the different densities, each RIMPAC ASW modeling area was examined to determine what percentage of the area was within 25 nmi of land. This was accomplished by using Nobeltec, a commercial visual navigational tool. The location of each RIMPAC ASW modeling area was placed on a map overlay. Circles with 25 nmi radii were drawn from locations on the closest landmasses. The percentage of the RIMPAC ASW modeling area within 25 nmi of land was calculated. These results are presented in Table C-3. In the final calculation of the harassment estimates the densities were applied with the same percentages. For example in RIMPAC ASW modeling area 1, 10.3% of the area is within 25 nmi of land. In calculating the harassment area for rough-toothed dolphin 10.3% of the harassment area used the density from Mobley and the remaining 89.7% of area used the density from Barlow. Supplemental Information (Navy 2005) indicated the likely presence of some species in the main Hawaiian Islands (e.g. Bryde’s whales) that had only been observed during NOAA surveys in the Northwest Hawaiian Islands, well outside the RIMPAC operational area. To be conservative, no species present In Barlow (2003) or Mobley (2000) were eliminated from consideration with the exception of humpback whales, which are not present in Hawaii during the July timeframe.

Table C-2 Density Estimates

Species	Offshore (Barlow, 2003)		Inshore (Mobley et al., 2000)	
	Density (animals/km^2)	CV (%)	Density (animals/km^2)	CV (%)
rough-toothed dolphin	0.0081	0.52	0.0017	62.8
dwarf sperm whale	0.0078	0.66	–	–
Fraser's dolphin	0.0069	1.11	–	–
Cuvier's beaked whale	0.0052	0.83	0.0006	51.2
spotted dolphin	0.0042	0.41	0.0407	45.1
striped dolphin	0.0042	0.48	0.0016	118.5
short-finned pilot whale	0.0036	0.49	0.0237	32.2
pygmy sperm whale	0.0030	0.77		
*sperm whale	0.0029	0.30	0.0010	56.0
bottlenose dolphin	0.0013	0.60	0.0103	55.7
melon-headed whale	0.0012	1.10	0.0021	88.3
spinner dolphin	0.0011	0.66	0.0443	36.5
Risso's dolphin	0.0010	0.65	–	–
Blainville's beaked whale	0.0009	0.77	0.0009	59.6
Longman's beaked whale	0.0003	1.05	–	–
pygmy killer whale	0.0003	1.12	–	–
Bryde's whale	0.0002	0.34	–	–
killer whale	0.0002	0.72	–	–
*fin whale	0.0001	0.72	–	–
false killer whale	0.0001	1.08	0.0017	47.3
*sei whale	0.0000	1.06	–	–
*blue whale	–	–	–	–
*North Pacific right whale	–	–	–	–
minke whale	–	–	–	–
Stenella spp.	–	–	0.0076	64.6
unidentified dolphin	–	–	0.0134	41.0
unidentified beaked whale	0.0001	1.05	0.0005	97.1
unidentified cetacean	–	–	0.0004	72.3
*Endangered species				

CV = Coefficient of Variation

Table C-3 Percentage of Modeled Area within 25 nmi of Land

Modeled Area	% within 25 nmi of land (Mobley)	% beyond 25 nmi of land (Barlow)
1	10.30%	89.70%
2	19.15%	80.85%
3	24.58%	75.42%
4	20.79%	79.21%
5	0.00%	100.00%
6	0.00%	100.00%

1 ACOUSTIC THRESHOLDS

1.1 Marine Mammal Harassment Criteria

This analysis model labels the results in terms of Level A Harassments and Level B Harassments and equates the terms to mean permanent threshold shift (PTS) and temporary threshold shift (TTS) respectively. The criteria used for onset-PTS and onset-TTS comes directly from the Draft *Overseas Environmental Impact Statement/Environmental Impact Statement, Undersea Warfare Training Range* (OEIS/EIS) where based on analysis "195 dB re 1 $\mu Pa^2 \cdot s$ is the most appropriate predictor for onset-TTS from a single, continuous exposure." Since data for onset-PTS is not available, analysis was used to determine a relationship between onset-TTS and onset-PTS. "An estimate of 20 dB between exposures sufficient to cause onset-TTS and those capable of causing onset PTS is a reasonable approximation."
Hence:

Level A Harassment (onset-PTS) = onset TTS + 20 dB = 215 and greater dB re 1 μPa^2-s
Level B Harassment (onset-TTS) = 195 to 215 dB re 1 $\mu Pa^2 \cdot$-s
Level B Harassment (behavioral disturbance) = 173 to 195 dB re 1 μPa^2-s

1.2 Acoustic Units

The analysis units used for the harassment thresholds are 1 μPa^2-s with the designation energy flux density. Derivation of the equation is contained in Appendix B, Underwater Sound Concepts, of the USWTR Draft OEIS/EIS. The equation used in the model is

$$L_E = SPL_{rms} + 10 \log_{10}\left(\frac{T}{T_{ref}}\right)$$

L_E is the energy flux density level and has units dB re 1 μPa^2-s. T is the time duration of the signal spread. SPL_{rms} is the root mean square sound pressure level, which by definition is defined as

$$SPL_{rms} = 10 \log_{10}\left(\frac{1}{T}\int_0^T\left(\frac{p^2(t)}{p_{ref}^{\,2}(t)}\right)dt\right)$$

where t is time and p is pressure.

By Parseval's theorem (Coleman, 1999; Gollisch, 2002, Marshall, 1996) that simply stated relates total energy in the time domain to that in the frequency domain, SPL_{rms} is directly related to the output level modeled by CASS. If the pulse length is greater that the total eigenray or signal spread, then T is the signal duration expressed in seconds. In the present study, this approximation of T is applicable since there is not significant multipath at 1 km.

The total energy flux received at a point in space (L_{E_total}) is the sum of the energy flux densities received at that point and is defined:

$$L_{E\_total} = 10 * \log_{10}\left[\sum_{i=1}^{N} 10^{\frac{LEi}{10}}\right] \text{dB re } 1\ \mu\text{Pa}^2 \cdot \text{s}$$

where N is the cumulative number of acoustic exposure events.

2 ACOUSTIC SOURCE AND SCENARIO DESCRIPTIONS

For RIMPAC 2006, the AN/SQS-53C surface ship sonar was modeled as the active source for all ships. The SQS-53C is the most powerful advanced hull-mounted surface ship ASW sonar in the U.S. Navy's inventory.

2.1 Acoustic Source Model Inputs

Establishing the acoustic effects on marine mammal populations requires the identification of the following source information:

- Number of acoustic sources to be used during RIMPAC 06
- Source center frequencies
- Source output levels
- Source pulse length and repetition rate
- Source beamwidth (horizontal and vertical)
- Operating depth(s) at which these sources are to be modeled
- Number of hours these acoustic sources are to be used

2.2 Exercise Description

Training events were modeled as described in Section 2 taking data derived from actual training times and locations during RIMPAC 2004, smaller scale ASW training events routinely undertaken in the Hawaiian Islands Operating Area, and RIMPAC 2006 exercise parameters as determined by exercise planners. Ship speed was modeled at 10 kts for all exercises except those taking place in Area 4 where speeds will be 20 kts. All active sonar is modeled using the operational characteristics of the SQS-53C.

3 UNDERWATER SOUND PROPAGATION ANALYSIS

The initial modeling step consists of calculating the acoustic propagation loss functions. The loss function includes variation by season, the depth regions defined for the analysis, and the source's operational characteristics (frequency, vertical and horizontal beam pattern, ping length, depth). Each analysis run incorporates bottom and surface reflection losses, multi-path reception of sound, absorption, and the ray traces resulting from the seasonal sound speed profile.

3.1 Level A propagation modeling

Some caveats exist for the Level A analysis, which produced no Level A harassments. First, for physically large sources, specifically a surface ship, the Level A harassment ranges is close to the acoustic transducers. In this circumstance, the actual level received by any mammal will be limited by shielding effects of the sonar's structure since the sonar source transducers are behind a surrounding dome on the bow that limits the ability to get close to the source. The analysis assumes that the acoustic energy is constant throughout the vertical water column at a given horizontal range from the source. For short distances, the slant range between the source and mammal may significantly exceed the horizontal distance resulting in a lower energy level being received. Last, the Level A harassment ranges for all sonars correspond to distances where striking the animal is a more immediate concern and ships take all possible steps to avoid striking marine mammals. Despite the very low likelihood of Level A harassment, its assessment using the described methodology was included for completeness.

Table C-4 Level A Harassment Range Example

Source Level	Ping Length	Total Energy Flux	Level A Threshold	Allowable Spreading Loss	Distance to Reach Level A Threshold
dB re 1μPa @1 m	S	dB re 1 μPa^2 S	dB re 1 μPa^2 S	dB	(20 Log R) m
215	1	215.00	215	0.00	1.00
220	1	220.00	215	5.00	1.8
225	1	225.00	215	10.00	3.1
230	1	230.00	215	15.00	5.6

3.2 Propagation Modeling

The six locations chosen as representative for the RIMPAC exercise were modeled with the Comprehensive Acoustic System Simulation Gaussian Ray Bundle (CASS/GRAB) model. CASS is an Oceanographic and Atmospheric Master Library (OAML) Navy Standard performance prediction model.

GRAB provides detailed multipath pressure information as a function of range, depth and bearing. The Gaussian beam approach provides a means for estimating energy leakage out of ducts and into shadow zones, significantly improving the ray-based model predictions and extending the operational realm to lower frequencies. For each path to a given receive point the total energy from all eigenrays is used to produce the (power summed) propagation loss. An illustration of this is provided in Figure C-4. GRAB allows input of range-dependent environmental information so that, for example, as the bottom depths and sediment types change across the range their acoustic effects can be modeled. The source's frequency and vertical beam pattern are also inputs used.

3.3 Acoustic Environment

Several environmental inputs are necessary to model the acoustic propagation on the OPAREAS: bathymetry, wind speeds, sound speed profiles, and bottom characteristics.

Digitized Bathymetric Data Base-Variable (DBDBV) bathymetry information was obtained from PCIMAT (Personal Computer Interactive Multisensor Analysis Trainer) and used as a bottom depth table in CASS. Sound speed information (Sound Speed Profile; SSP) was obtained from the NAVO Generalized Digital Environmental Model (GDEM 3) https://128.160.23.42/gdemv/gdemv.html. All SSPs are for July since that is the planned time frame for RIMPAC 2006 and are displayed in Figure C-5.

Each operating area was examined to determine if there was a variation in propagation across the range site focusing on bathymetric contours. Although several of the areas (1, 2, and 4) have some shallow water area, the shallow water area is limited and quickly deepens. Generally, the exercise locations are deep ocean sites with little variability across the area. A single analysis point was selected for each area to use for the full CASS propagation analysis. The analysis point for each area is as follows:

Area	**Analysis Point**
1	latitude: 23.50 N longitude: 160.50 W
2	latitude: 22.25 N longitude: 158.00 W
3	latitude: 21.00 N longitude: 159.25 W
4	latitude: 20.25 N longitude: 155.00 W
5	latitude: 19.00 N longitude: 157.75 W
6	latitude: 19.00 N longitude: 159.25 W

Specifically, transmission loss was calculated using CASS for all ranges, depths and bearing angles and results processed in MATLAB to determine the maximum received levels. Range values varied from 5 to 1000 meters in 5-meter increments. Receiver depths varied from 5 meters to actual bottom depth in 5-meter increments. Bearing angles varied from 0 to 360 degrees in 90-degree increments.

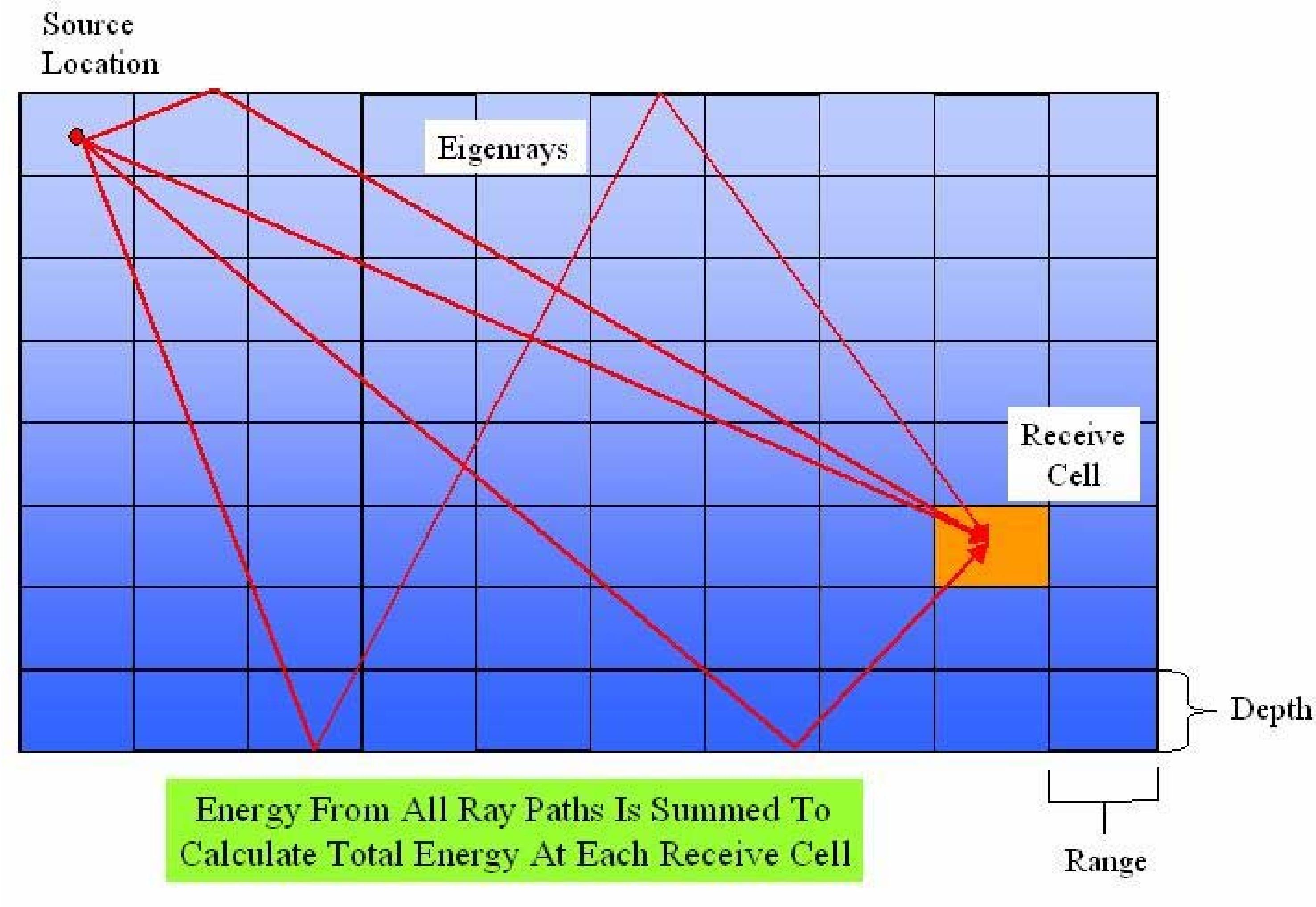


Figure C-4 CASS/GRAB Propagation Loss Calculations

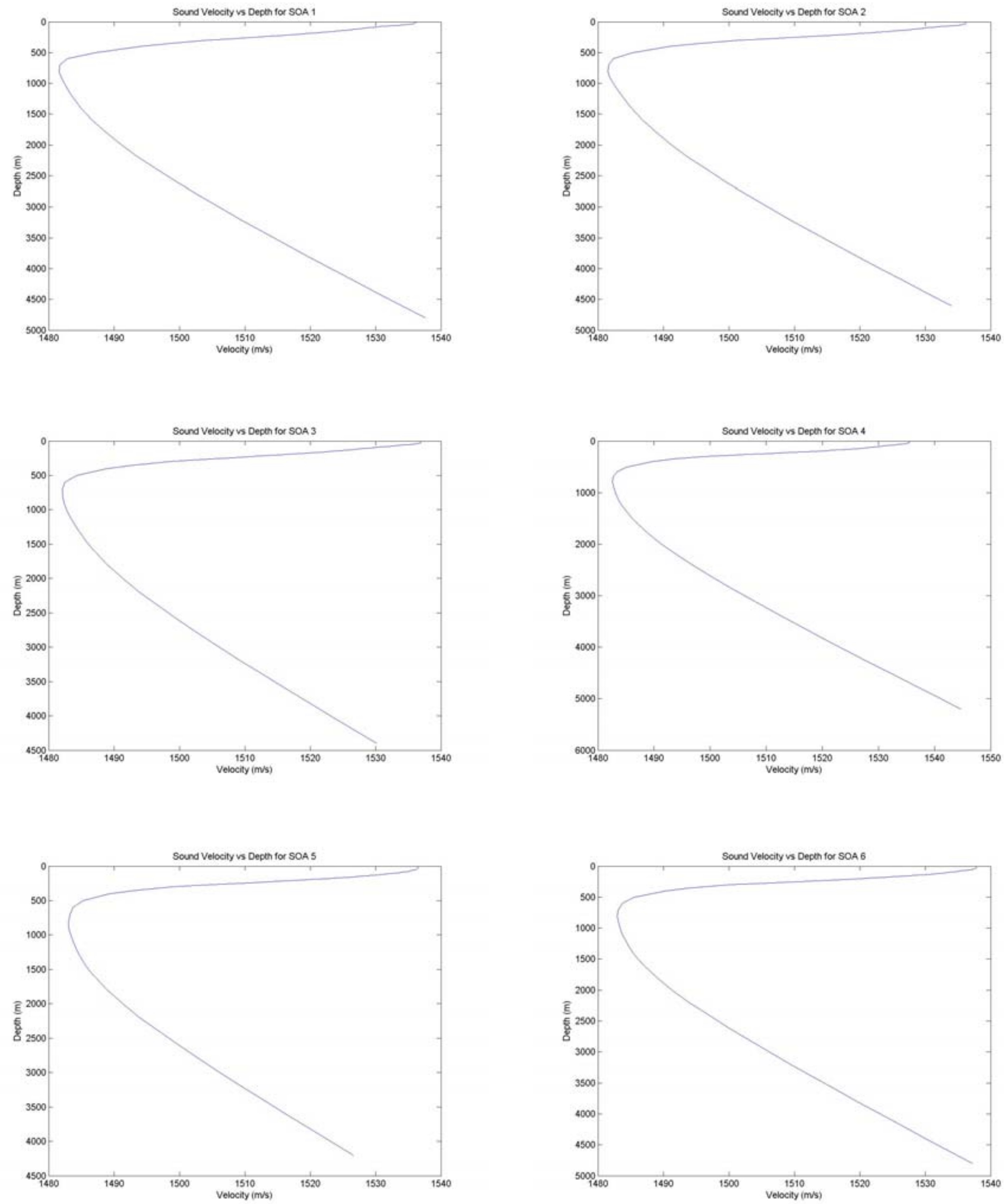


Figure C-5 Sound Speed Profiles for the Representative Modeled Exercise Areas 1-6

4 HARASSMENT CALCULATIONS

This section describes the method by which the estimated number of marine mammals that would be subjected to acoustic sources above the acceptable marine mammal acoustic effect harassment definition is calculated. This analysis combines the input data on marine mammal distribution and density, the Level A and Level B harassment thresholds, and the acoustic propagation analysis.

4.1 Assumptions

Inherent to the harassment prediction model is the consideration of the marine mammal distribution, hearing, and diving behavior. In this analysis, no attempt was made to predict animal behavior in response to sound in the water or their location relative to the point where the source initiates operation. In other words, it was not assumed that they would leave the area if they heard the sonar. It was conservatively assumed that mammals have omni-directional hearing. This approach was used because there was no basis provided for the mammal responses over time to the sources. It was also conservatively assumed that mammals were exposed to the maximum receive levels calculated for the horizontal distance to the source at any water depth for that distance although direct path sound transmission was not always likely. Lastly, animals were distributed with a static, uniform density across the range area. The mammal density data does not provide a basis for reflecting greater resolution in their location and prediction of animal movements, which thereby result in changes in density distributions that can't be substantiated.

4.2 Acoustic Footprint Calculation

For each CASS propagation analysis run, an acoustic footprint was calculated. This set of footprints delineates propagation variation versus source operating mode and operating depth at each analysis point.

The first step is to convert the CASS Propagation Loss vs. Range and Depth for each bearing angle to a single Maximum Receive Level vs. Range curve as shown in Figure C-6 (the values in Figure C-6 are illustrative). The maximum received level is accomplished by filtering the minimum propagation loss at each range increment and adding the source's output Sound Level (SL).

The acoustic footprint is generated by translating the maximum receive level vs. range along the four bearing spokes into a continuous two-dimensional array. From each bearing angle the maximum receive level curve is used to populate all angles around the source. This results in a continuous 360 degree characterization of the receive level from the source. Based on the propagation characteristics, the size of the footprint for the each acoustic propagation modeling area is different since the footprint is constructed to include energy out to 140 dB. The footprint radius for each modeling area is as follows:

Area 1 – 24,000 meters	Area 2 – 58,000 meters	Area 3 – 36,300 meters
Area 4 – 58,000 meters	Area 5 – 60,000 meters	Area 6 – 70,000 meters

The source's horizontal beam pattern is applied to this characterization to yield a directional footprint as depicted in Figure C-7.

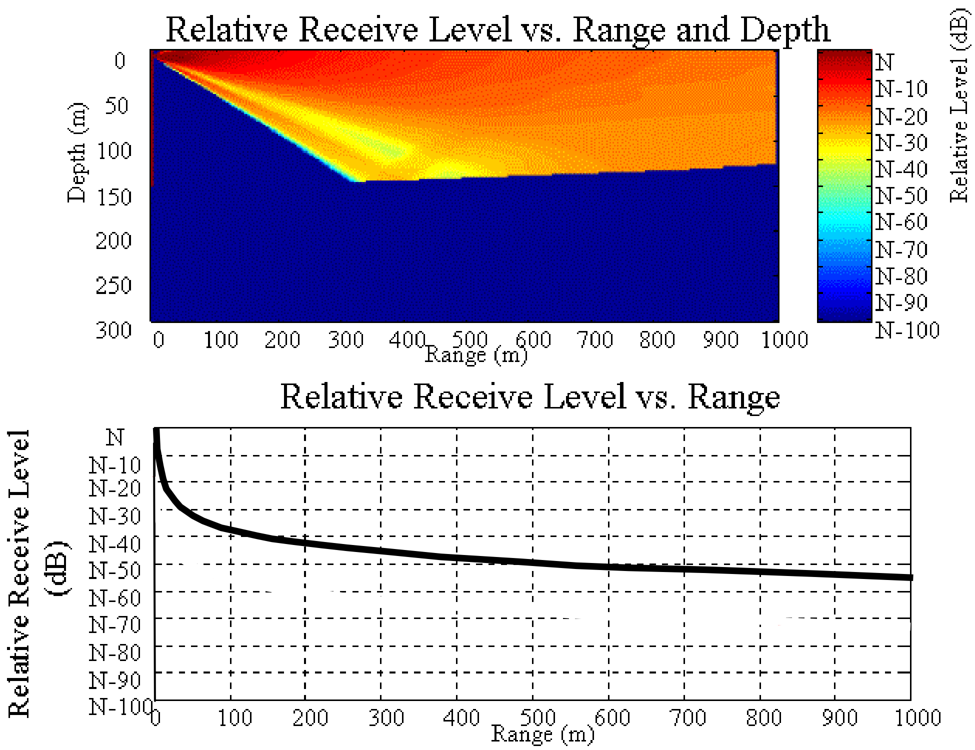


Figure C-6 CASS Propagation Output and Corresponding Maximum Receive Level Vs Range Curve

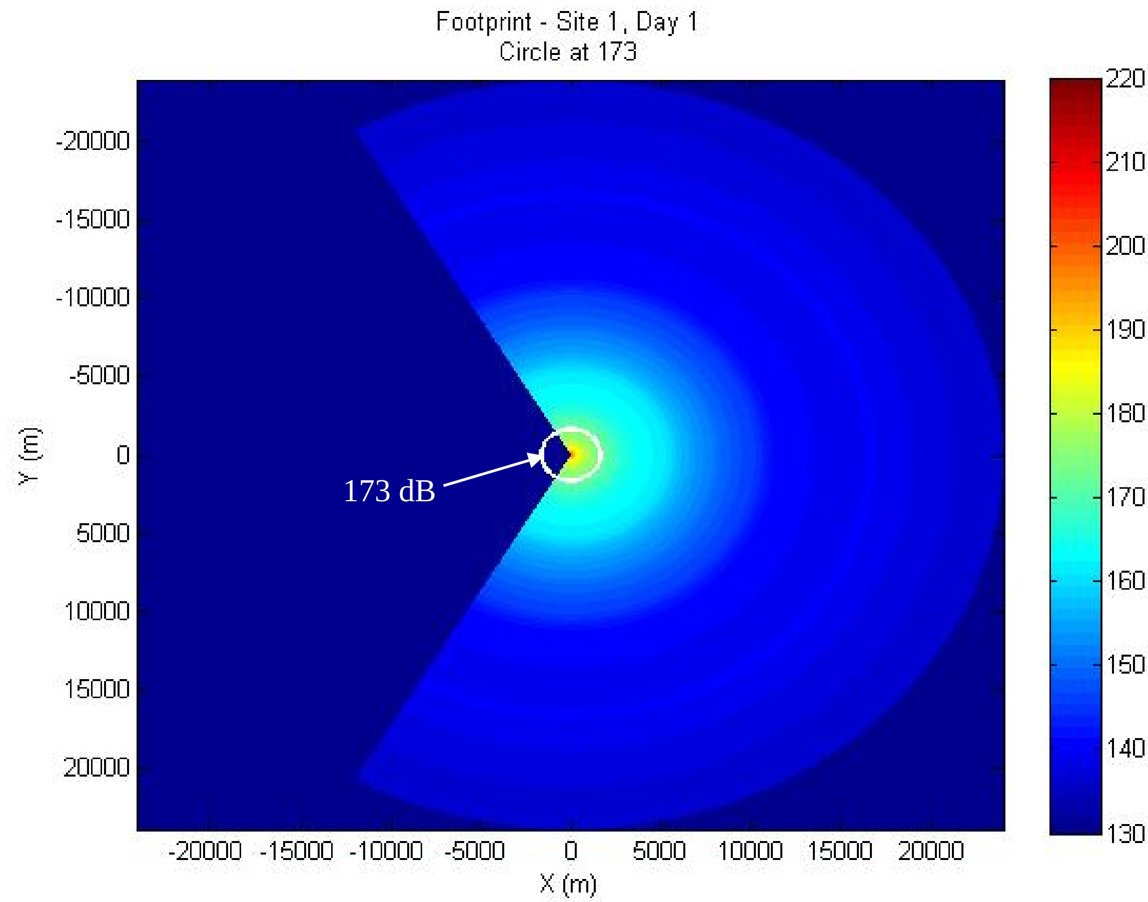


Figure C-7. Typical Directional Acoustic Footprint for RIMPAC ASW Modeling

The distance resolution in the acoustic footprint (25 m) equals five times that of the CASS propagation analysis. Thus, each data point within the acoustic footprint represents an area of 25 m^2. The maximum receive level of the five points within the 25 m interval is selected as the single data point for the acoustic footprint. For example, the minimum loss for 105, 110, 115, 120 and 125 m would be used for the single footprint value covering 100 to 125 m. An analysis was conducted to determine the maximum decimation in this step that could be implemented without compromising the accuracy of the results. The positive benefit of this step is reduction in the number of receive cells that must be modeled for the range area reducing processing time by an order of magnitude.

4.3 Modeled Source Paths

For each operational area and period, the model was run for operational parameters of the SQS-53C. Since the proposed exercise centers on a detection of a target, the actual run geometry is random and searching. However, it is not unrealistic to assume that if a contact is made there may be a return sweep of an area. To account for this occurrence, relative extremes were considered and averaged. It is difficult to predetermine which geometry will provide the best case (minimum harassment area) and which will provide the worst case (maximum harassment area) because it is dependent on the operational characteristics of the source and the specific propagation loss for the area. The geometries that provide the relative extremes are a straight-line continuous track and a track that perfectly overlays itself. In this modeling effort, the overlaid track was considered to be 50% of the expected run duration. For each event two geometries were modeled. For example, if an event lasted six hours, a model run was conducted for a straight-line track that lasted six hours and then a model run was made for a six-hour track where after three hours of travel the vessel came back on the same track for three hours. The resultant harassment areas were averaged. This average area was used to represent that particular event.

4.4 Receive Cell Level Calculations

The receive levels are calculated for each data cell for the entire analysis area. The receive cells extend to 1 Km beyond the range's boundary as sound is not restricted from propagating outside of the instrumented tracking area. For the source paths the receive level is recorded for each modeled ping in all cells overlapped by the acoustic footprint. Any receive cell not overlapped by the acoustic footprint records no received ping.

To perform the receive cell level calculation for a moving source, it is positioned at one end of the path being analyzed. The receive levels are determined by overlaying the acoustic footprint on the source point and storing the footprint's values in all overlapped receive cells. This is shown conceptually in Figure C-8. The source point is then incremented along the source path to the next point and the process repeated. The distance moved along the path is calculated from the vessel speed and the time interval between pings. For example if a ship is moving at a speed of 18.5 Km/hr (10 knots) and pinging at an interval of 30 seconds the next analysis point would be 154.2 m further along the path. Incrementing the source point continues until the full path has been completed. Receive cell data is generated for each source, period, and location.

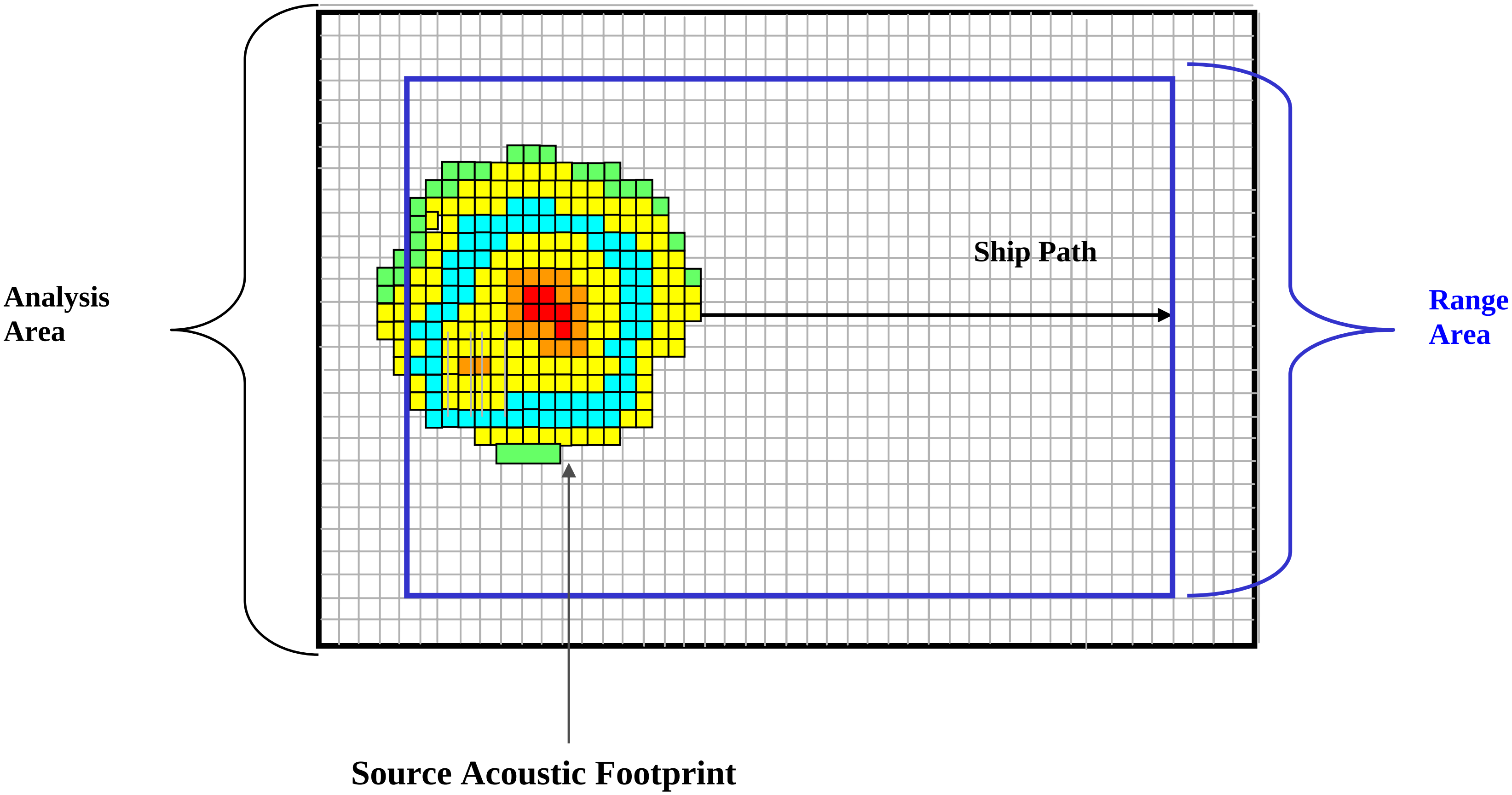


Figure C-8 Modeling a Source's Movement Along a Track

An illustration of the receive level of each ping versus time for a single receive cell is shown in Figure C-9. This example represents a point where a directional source's track passed directly over the cell. This produces the slope up in the received level as the source moves towards the cell. After passing the cell the receive level is zero as this cell is out of the horizontal beamwidth of the source.

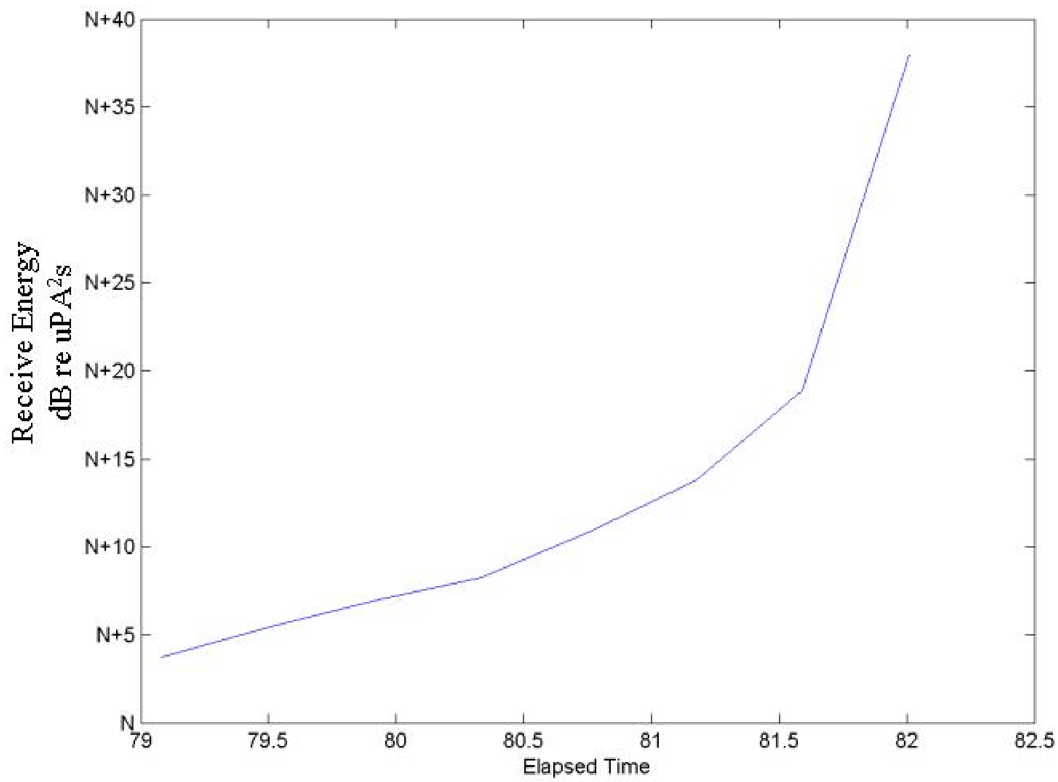


Figure C-9 Example of the Receive Level vs. Time for One Geographic Cell

4.5 Total Energy Flux Calculations

The total energy flux calculation determines the level received at each geographic cell on the range area from each ping signal and stores the data in a matrix. Calculating each cell's receive levels combines the acoustic footprint with source speed and the operational duty cycle characteristics such as ping repetition rate. The matrix is uniquely calculated for each source and location. Each cell corresponds to specific region of the range area, i.e. a 25 m x 25 m square. As described above, the cell size is adjusted to be five times larger than the resolution in the propagation analysis.

The acoustic energy (AE) map is a display of the total energy flux accumulated from a modeled source, taking into account the intensity, duration and number of received pings. The total AE is calculated from the acoustic energy matrix data for each cell. The data for received pings within each grid cell is converted to a total energy flux value for that cell. An example of an AE map is shown in Figure C-10. Areas along the path are those at the highest total energy. The energy decays as the distance from the vessel track increases. In this example, the transmission point (red cell) for each individual ping can be observed. The track also shows the effect of the source's horizontal beamwidth.

4.6 Marine Mammal Threshold Analysis and Harassment Rate Calculation

Once the total acoustic energy is calculated for a given source and source path, determination can be made for each individual cell whether the harassment thresholds have been exceeded. The determination is a comparison of the total energy flux calculated to the harassment thresholds determined in Section 4.1. The comparison records the number of cells greater than or equal to the thresholds. The cell count is converted to a total area for which the threshold has been exceeded based on the modeled cell size. For example if each cell is 25 m x 25 m and the number of cells above the threshold is 500 the total harassment area would be .3125 km^2. These resulting areas are exported to the spreadsheet analysis that generates the estimation of the number of harassments.

4.7 Spreadsheet Analysis

The spreadsheet analysis calculates the average area per source per day per location. Tactical considerations provided a description of the event where multiple surface ships are sufficiently separated geographically that there would be no significant overlaying of their areas. Hence, the modeling looked at the length of operation of the ship on a 24-hour basis. The result is a sum of the average areas per ship (best and worst case) in one location for a given event period. The areas are calculated for each threshold and applied to the mammal density per specie. As described in Section 3, the density tables were applied by percentage and the results added to generate an estimated harassment number per specie, per period per location. The areas are bounded by the thresholds so that animals are not counted twice for one period's operation.

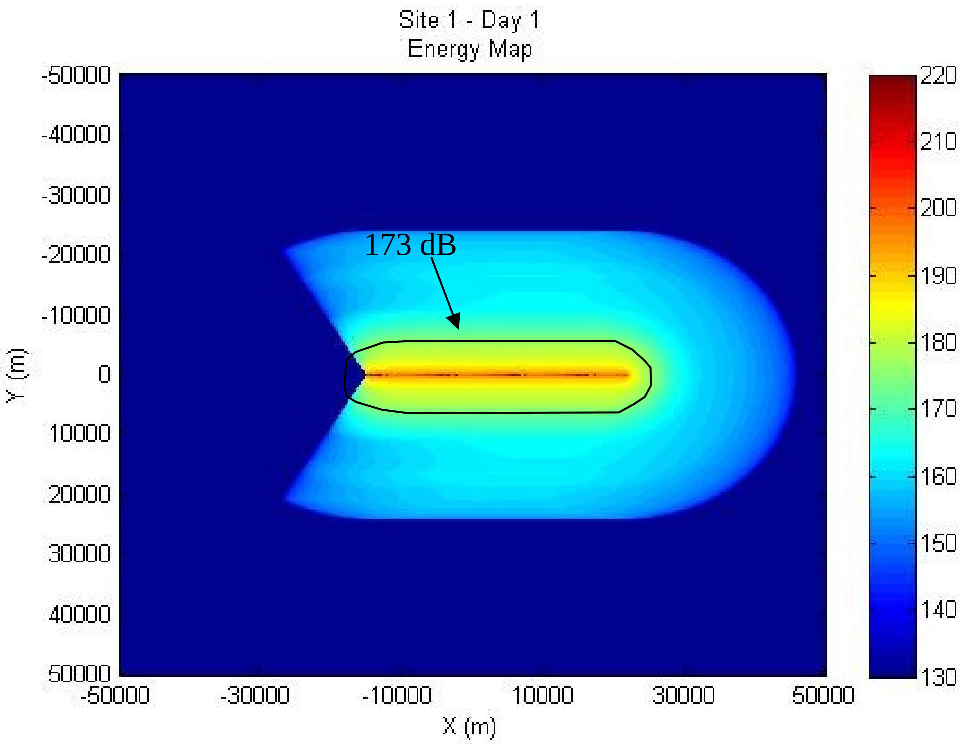


Figure C-10 Example of an Acoustic Energy Map

5 RESULTS

The harassment estimates were rounded to the nearest integer since an estimated harassment of 0.5 $\leq$ 1 < 1.5 animals is considered one animal for MMPA. For endangered species, the criterion is 0.05. For these species, an estimated effect on 0.05 $\leq$ 1 < 1.05 animals is considered 1 animal, hence an effect of 1.05 to 2.04 is considered 2 animals. The modeled harassment numbers by species and location are presented in Table C-5. The modeling for RIMPAC 2006, analyzing the potential interaction of mid-frequency sonars with marine mammals in the Hawaiian Islands Operating Area, indicates the potential for a total of 15,623 Level B harassment exposures during RIMPAC 2006.

Table C-5 Modeled Level B Exposures (173≤EL<215)

MARINE MAMMAL SPECIES	RIMPAC ASW MODELING AREA All numbers are Level B harassment						TOTALS		
	1	2	3	4	5	6	TTS Total	Sub-TTS Total	TOTAL
Rough-toothed dolphin	8	1,880	381	162	329	1,098	49	3,809	3,858
Dwarf sperm whale	8	1,769	627	153	355	1,034	48	3,898	3,946
Fraser's dolphin	7	1,565	317	135	314	915	41	3,212	3,253
†Cuvier's beaked whale	5	1,193	220	103	239	697	29	2,428	2,457
Spotted dolphin	9	2,013	406	173	405	1,175	52	4,129	4,181
Striped dolphin	5	994	601	86	199	579	26	2,438	2,464
Short-finned pilot whale	6	1,432	290	124	287	836	37	2,938	2,975
Pygmy sperm whale	3	650	135	58	136	399	14	1,367	1,381
*Sperm whale	6	692	145	60	141	407	34	1,417	1,451
Bottlenose dolphin	3	562	114	48	92	329	11	1,137	1,148
Melon-headed whale	2	327	64	28	66	138	4	621	625
Spinner dolphin	6	1,303	283	121	281	819	37	2,776	2,813
Risso's dolphin	1	178	45	19	45	158	3	443	446
†Blainville's beaked whale	1	178	45	19	45	158	3	443	446
†Longman's beaked whale	0	67	14	6	14	39	0	140	140
Pygmy killer whale	0	67	14	6	14	39	0	140	140
Bryde's whale	0	47	9	4	9	27	0	96	96
Killer whale	0	47	9	4	9	27	0	96	96
*Fin whale	1	31	7	2	6	17	3	61	64
False killer whale	0	66	14	6	13	38	0	137	137
*Sei whale[1]	0	13	3	1	3	8	1	27	28
*Blue whale	0	0	0	0	0	0	0	0	0
Minke whale	0	0	0	0	0	0	0	0	0
Stenella spp.	1	201	40	17	40	116	3	412	415
Unidentified dolphin	2	305	70	30	68	201	4	672	676
†Unidentified beaked whale	0	36	7	3	6	22	0	74	74
Unidentified cetacean	0	11	1	1	2	5	0	20	20
*Monk seal[1]	0	1	0	0	0	0	1	0	1
TTS Total	2	232	53	9	31	73	400		
Sub-TTS Total	72	15,396	3,808	1,360	3,087	9,208		32,931	
Total Sub-TTS and TTS by Location	74	15,628	3,861	1,369	3,118	9,281			33,331

Notes:

* Endangered Species

† Beaked whales

[1] Calculated using percentage of fin whale Hawaiian stock number. Sei is 44% of fin; Monk seal is 32% of fin.

ACRONYMS AND ABBREVIATIONS for APPENDIX C

AE	Acoustic Energy
AHA	Acoustic Hemispherical Array
CNO	Chief of Naval Operations
CW	Continuous Waveform
dB	Decibel
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
EL	Energy Level
FM	Frequency Modulation
fm	Fathom
Km	Kilometer
LFBLTAB	Low Frequency Bottom Loss Model
m	Meter
MF	Mid Frequency
MGS	Marine Geophysical Survey
MMPA	Marine Mammal Protection Act
nmi	Nautical Mile
NAVO	Naval Oceanographic Office
NOAA	National Oceanographic Atmospheric Administration
NODC	National Oceanographic Data Center
NUWC	Naval Undersea Warfare Center
OAML	Oceanographic and Atmospheric Master Library
OEIS	Overseas Environmental Impact Statement
OPAREA	Operational Area
Pa	Pascal
PTS	Permanent Threshold Shift
rms	Root Mean Square
sonar	Sound navigation and ranging
SPAWAR	Space and Naval Warfare Systems Center
SPL	Sound Pressure Level
SSP	Sound Speed Profile
SWTR	Shallow Water Training Range
TM	Technical Memorandum
TTS	Temporary Threshold Shift
USWTR	Undersea Warfare Training Range

APPENDIX D—HANALEI BAY EVENT JULY 3, 2004

Part 1—Acoustic Reconstruction

The range-dependent predicted sound speed fields for 2-3 July 2004 in the immediate vicinity of the Pacific Missile Range Facility and Hanalei Bay exhibit a weak but definite surface duct. A weak surface duct is present in the historic sound speed profiles and in the in situ data collected during RIMPAC 2004. The in situ data is for a time later than 3 July 04 (i.e., from 6-21 July 2004). Some overlap exists between the times of the predicted sound speed fields and the in situ data.

The model results reported here include range-dependent bottom parameters. Because the dominant acoustic path is the duct, the effects of the geoacoustics and any bottom interactions are minimal on the direct path received levels, especially up to the mouth of the Bay.

Transmission loss modeling was executed for several ship locations as reported for the morning of 03 July 2004. It was found that because of the surface duct, sound could propagate from each ship location to the mouth of and into Hanalei Bay. This modeling was done at 4000Hz. An array configuration comparable to the 53C was used and the source level was assumed to be 236dB. The array was steered down 3 dg.

Subsequent figures (D-1 through D-6) show the transmission loss over the entire range from each ship (HRN, ASK, and INZ) to the bay, and a close-up of the received levels (in dB re 1 micropascal) at the bay. The figure with the entire range also includes statistics of the received levels in the bay.

The predicted mean received level at the mouth of and inside Hanalei Bay from ship HRN at 0645 (local) on 03 Jul 04 is 148.4 dB. This level spanned the water column from about 2m below the surface to 20-25 m deep outside the Bay and to the bottom inside the Bay. Below 25m outside the Bay the levels drop 10-30dB.

Additionally, using sound speed fields predicted every three hours from 0000Z on 2 July till 2100Z on 4 July, the predicted mean received levels from ship HRN (using location at 0645) ranged from 141.2 to 148.6 dB (with an average of 147.5).

The predicted mean received level at the mouth of and inside Hanalei Bay from ship ASK at 0700 (local) on 03 July 2004 is 145 dB. This level spanned the water column from about 2m below the surface to 20-25 m deep outside the Bay and to the bottom inside the Bay. Below 25m outside the Bay the levels drop 10-30dB.

Additionally, using sound speed fields predicted every three hours from 0000Z on 02 July till 2100Z on 04 July, the predicted mean received level from ship ASK (using location at 0700) ranged from 137.9 to 145 dB (with an average of 144).

The predicted mean received levels at the mouth of and inside Hanalei Bay from ship INZ at 0756 (local) on 03 July 04 are is 149.2 dB. (Note ship INZ is closer to Hanalei Bay than ships HRN and ASK.) This level spanned the water column from about 2m below the surface to 20-25 m deep outside the Bay and to the bottom inside the Bay. Below 25m outside the Bay the levels drop 10-30dB.

Predictions for ships PHM at 1521, and LKE at 1615 will result in similar levels to ships ASK and INZ. Predictions for ship HRN at 0900 will produce lower levels due to the increase in range.

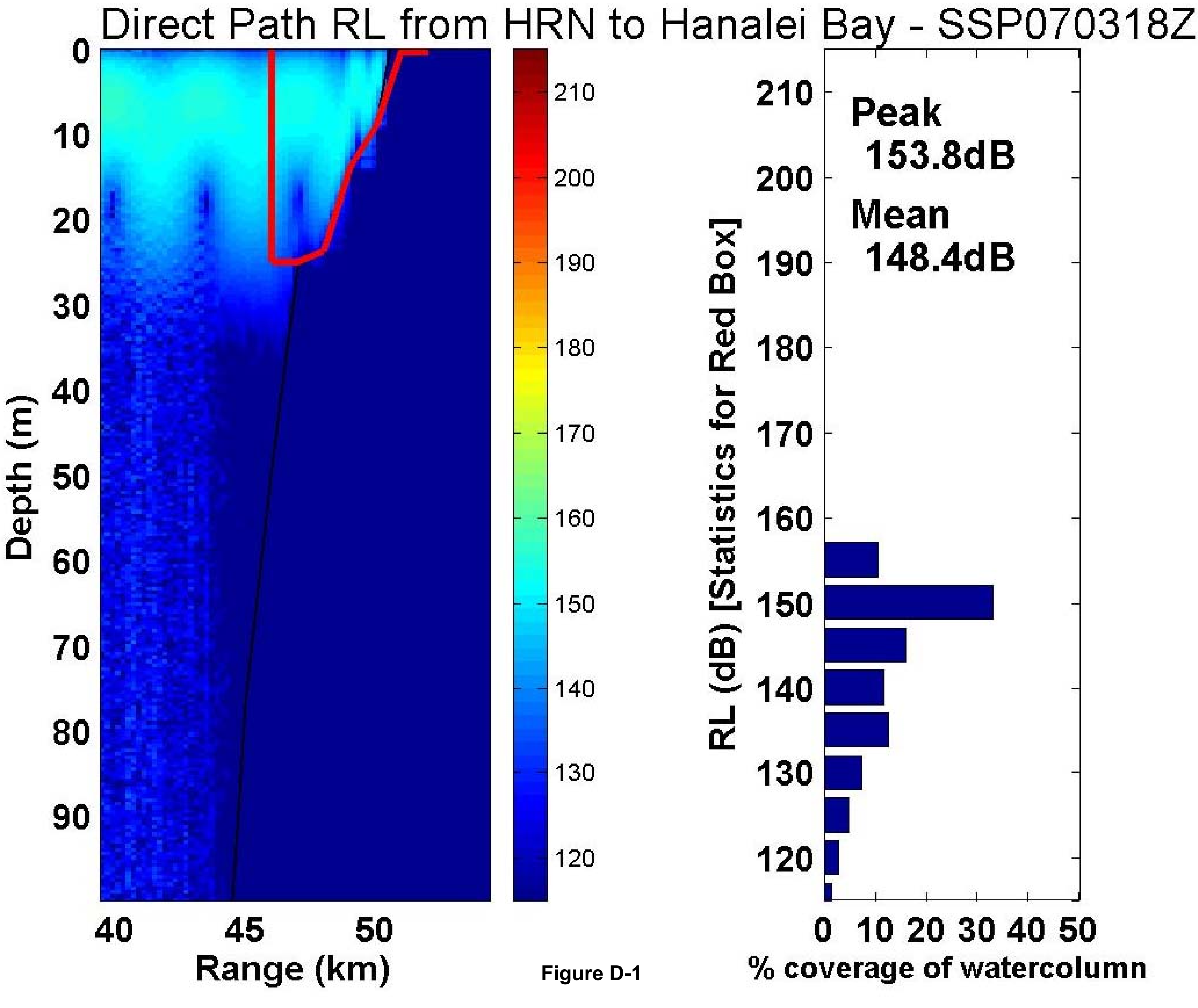

Direct Path RL from HRN to Hanalei Bay - SSP070318Z
Depth (m)
0
10
20
30
40
50
60
70
80
90
40
45
50
Range (km)
210
200
190
180
170
160
150
140
130
120
RL (dB) [Statistics for Red Box]
Peak
153.8dB
Mean
148.4dB
0 10 20 30 40 50
% coverage of watercolumn

Figure D-1

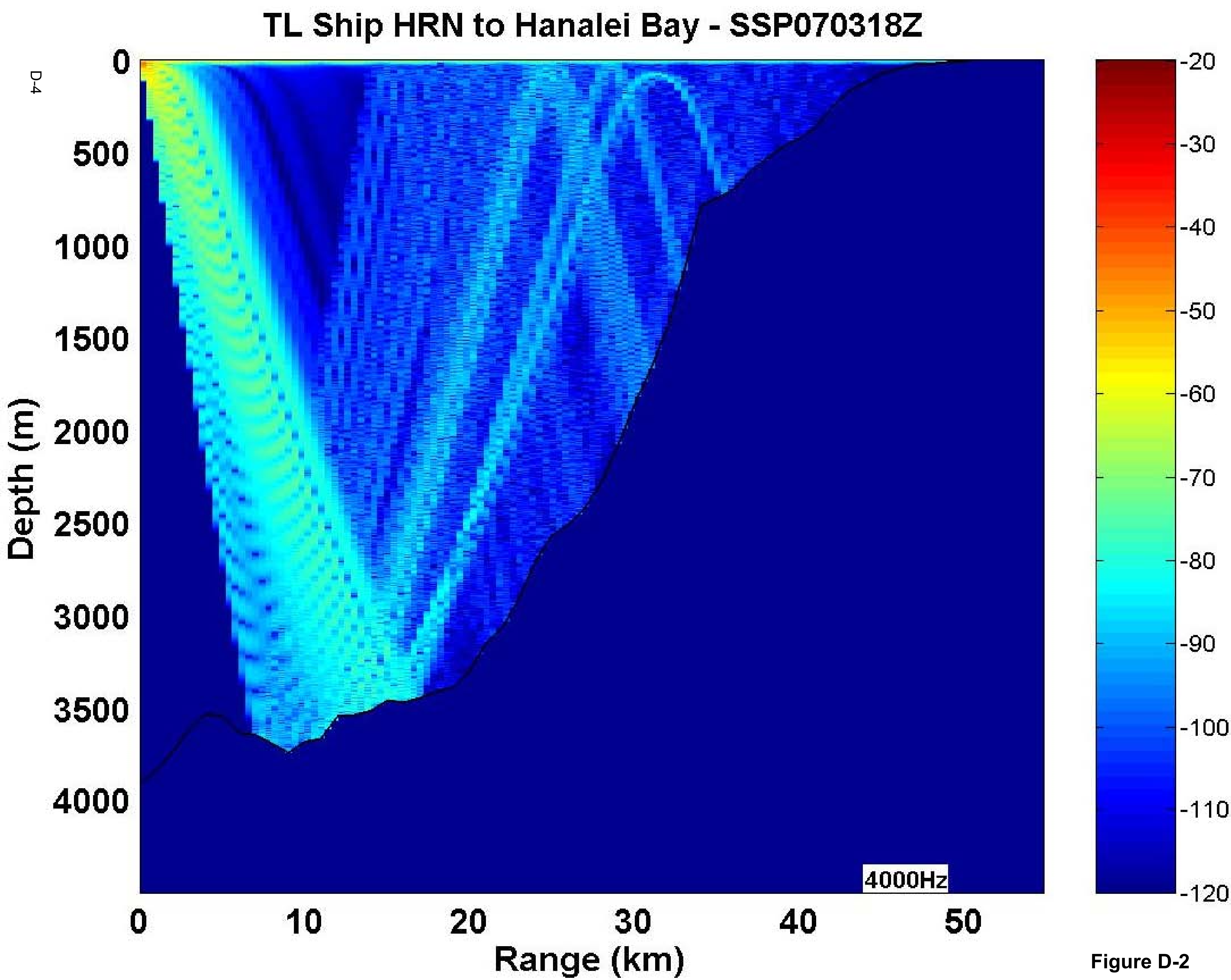

TL Ship HRN to Hanalei Bay - SSP070318Z
Depth (m)
0
500
1000
1500
2000
2500
3000
3500
4000
Range (km)
0
10
20
30
40
50
4000Hz
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120

Figure D-2

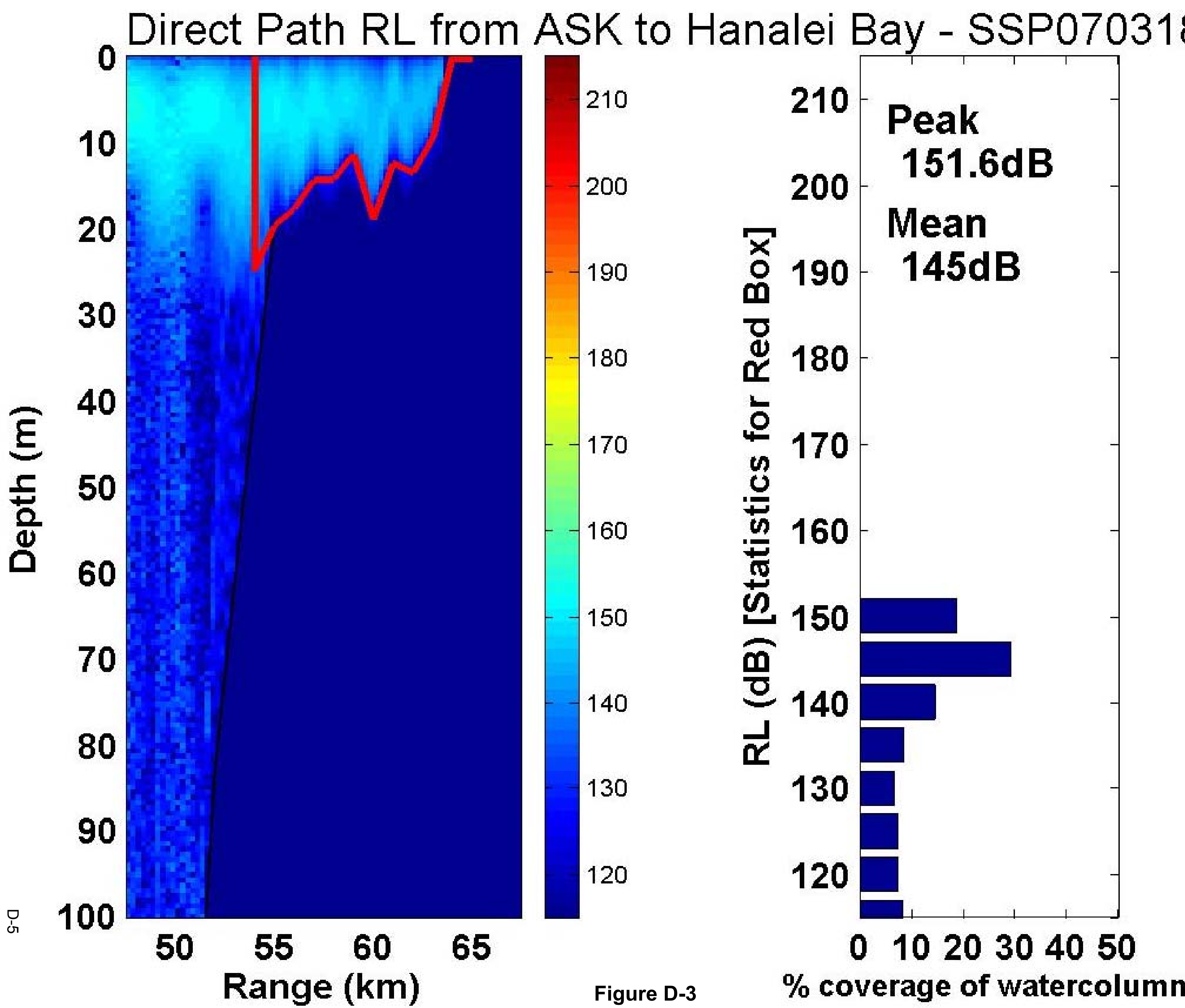

Direct Path RL from ASK to Hanalei Bay - SSP070318Z
Depth (m)
Range (km)
Peak
151.6dB
Mean
145dB
RL (dB) [Statistics for Red Box]
% coverage of watercolumn

Figure D-3

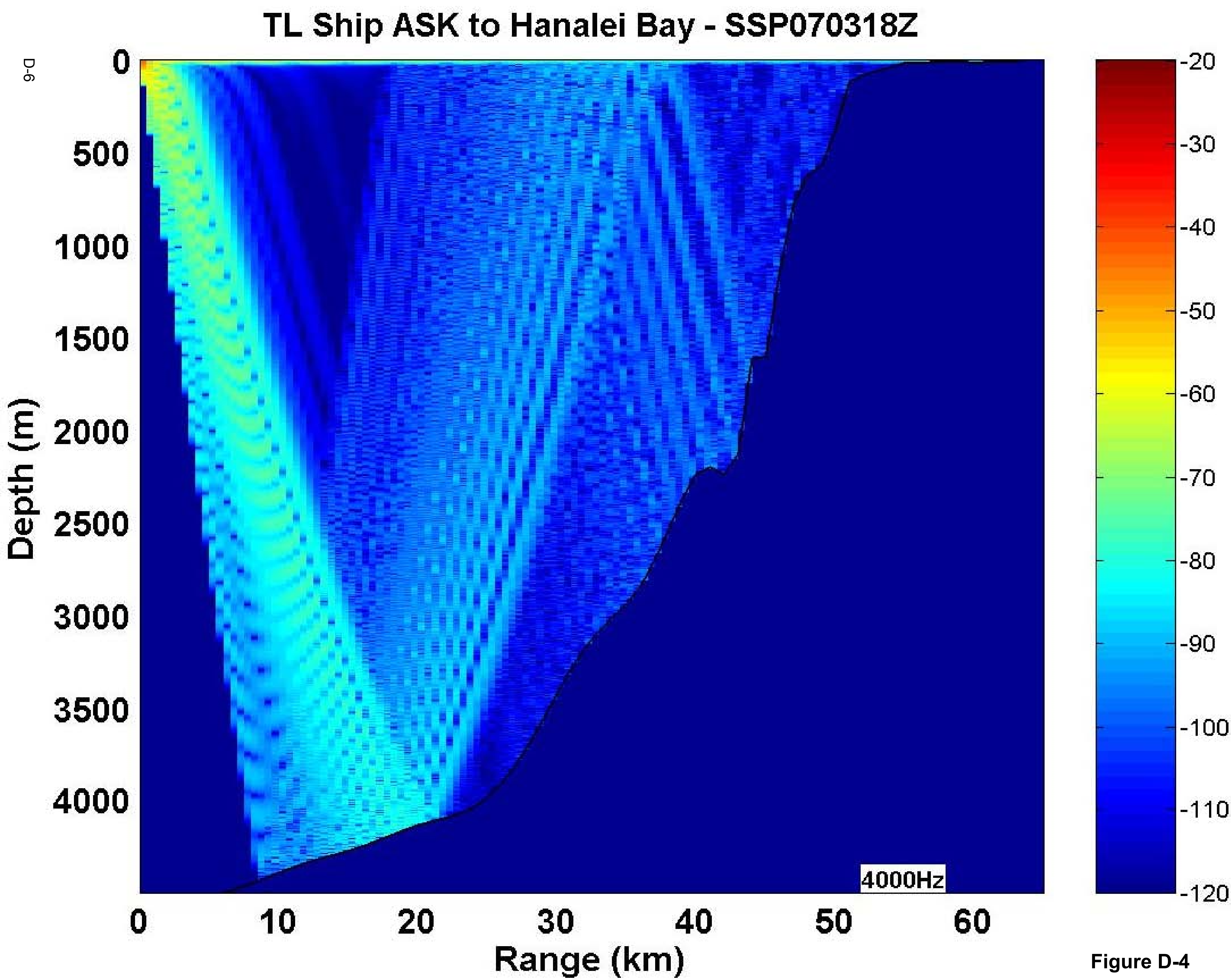

TL Ship ASK to Hanalei Bay - SSP070318Z
Depth (m)
0
500
1000
1500
2000
2500
3000
3500
4000
Range (km)
0
10
20
30
40
50
60
4000Hz
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120

Figure D-4

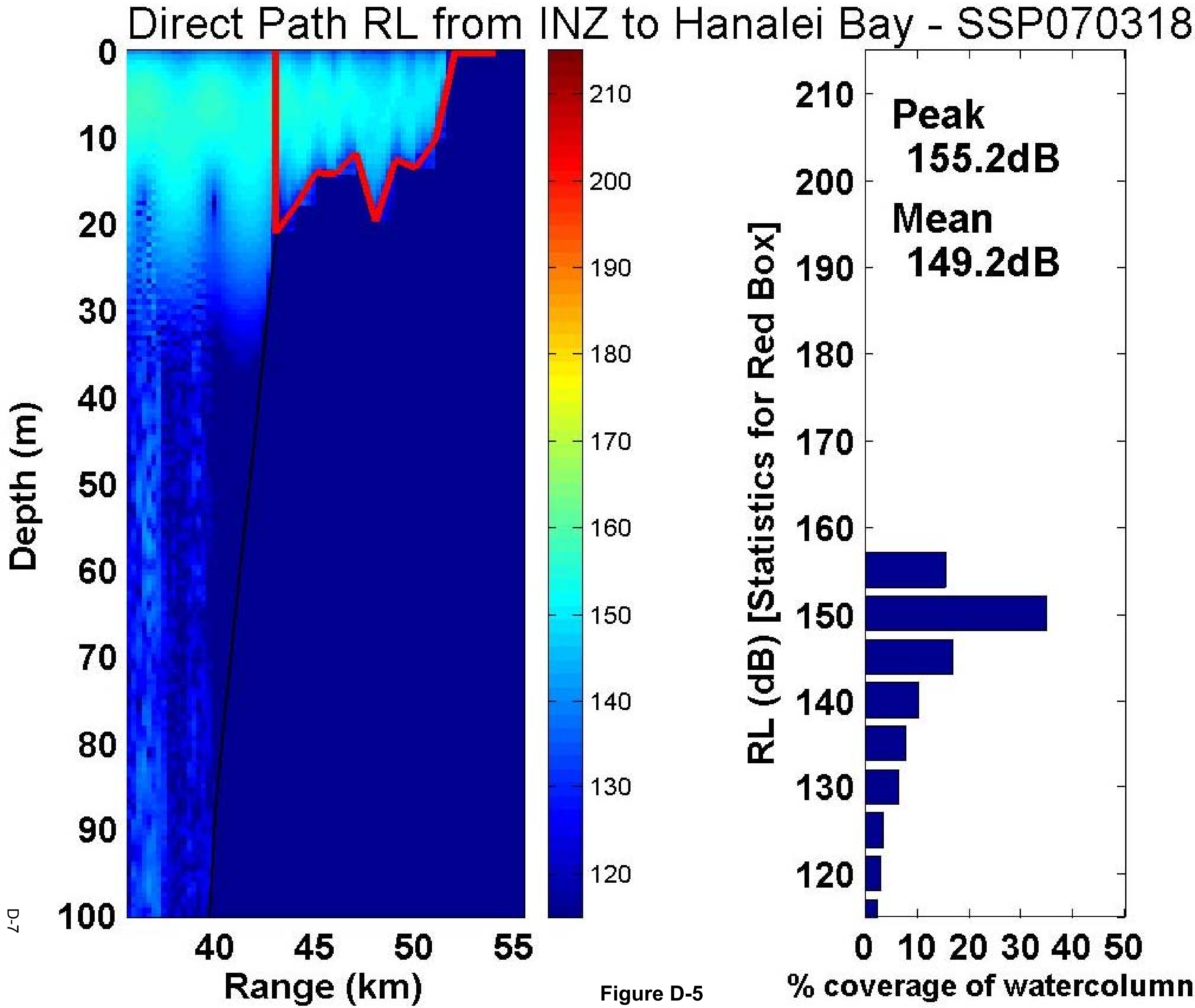

Direct Path RL from INZ to Hanalei Bay - SSP070318Z
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
40
45
50
55
Range (km)
210
200
190
180
170
160
150
140
130
120
Peak
155.2dB
Mean
149.2dB
RL (dB) [Statistics for Red Box]
0 10 20 30 40 50
% coverage of watercolumn

Figure D-5

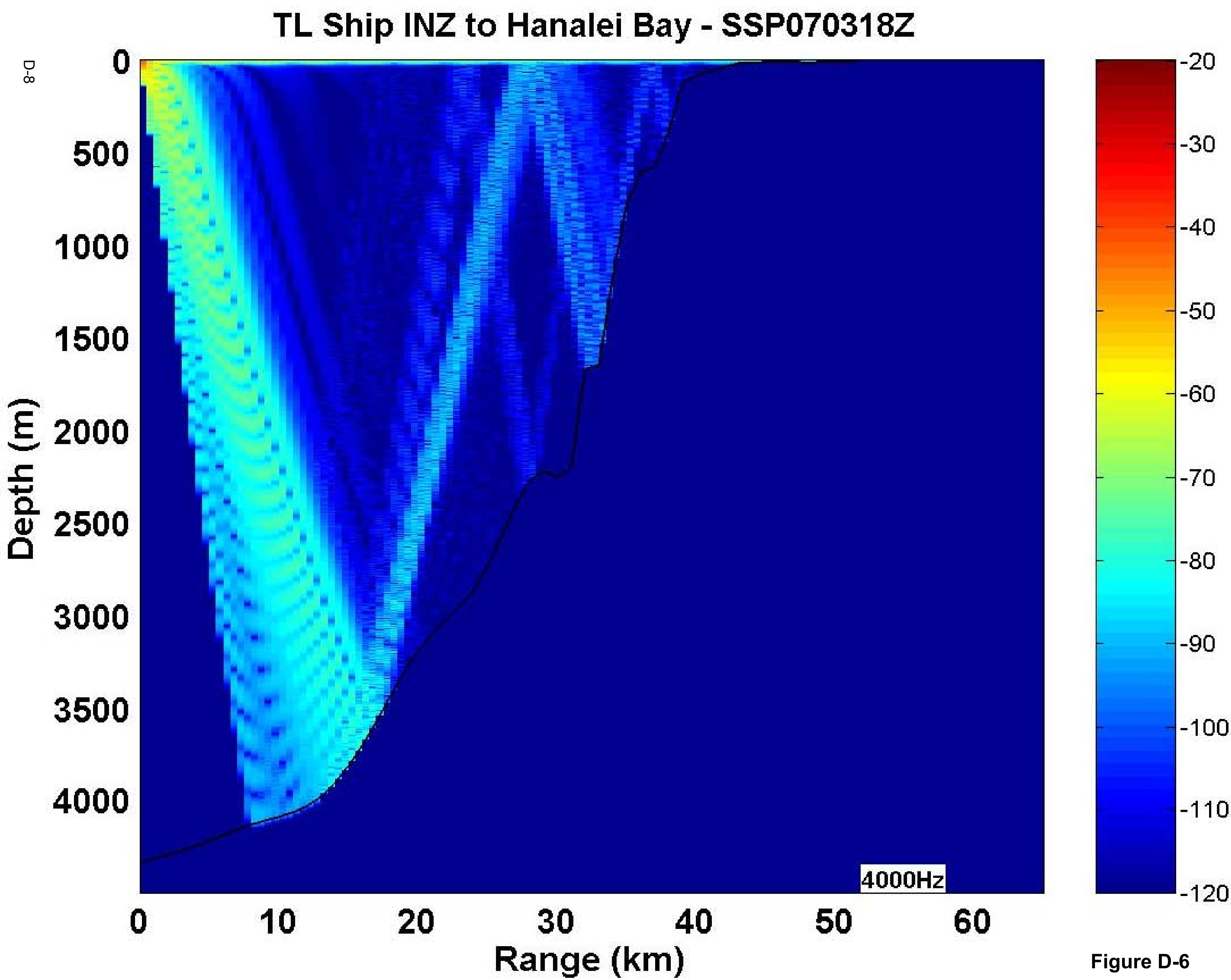

TL Ship INZ to Hanalei Bay - SSP070318Z
Depth (m)
0
500
1000
1500
2000
2500
3000
3500
4000
Range (km)
0
10
20
30
40
50
60
4000Hz
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120

Figure D-6

Part II—Biological Analysis

On July 3, 2004, a pod of melon-headed whales (*Peponocephala electra*) aggregated in the shallow waters of Hanalei Bay, Kauai. Appearance of melon-headed whales (PEPE) in Hanalei Bay is not a typical occurrence, although they have been reported in windward Kauai waters (Baird et al., 2003; Mobley et al., 2000; Mobley, 2004). At the same time, RIMPAC 2004 (henceforth, "RIMPAC") activity was being conducted including some sonar exercises off Kauai. Public attention quickly turned to RIMPAC and associated active sonar. In this analysis, existing biological data and sound field modeling presented in Part I were used to further analyze the July 2004 events to test the hypothesis that sonar was the cause of the PEPE aggregation. Presented in the following paragraphs is a timeline of RIMPAC activity and whale observations in waters near Kauai, and a brief review of PEPE natural history. The analyses are described including the operating assumptions that were made, concluding with findings, along with caveats and limitations of analytic and inferential accuracy.

Timeline

July 2. RIMPAC units used active sonar in waters more than 20 nmi south of the channel between Kauai and Oahu (Figure D-7). Transmission began in the afternoon and the last ping was at approximately 0027 on July 3. Sonar transmissions were never closer than 20 nmi SE of Kauai, with Hanalei Bay in the sound shadow on the north coast. Location of the PEPE is unknown.

July 3. RIMPAC units used active sonar in waters more than 20 nmi north of the channel between Kauai and Niihau (Figure D-7). Intermittent testing began at 0645 and the scheduled exercise began at 0800. At time of first ping, the source was over 25 nmi NNW of Hanalei Bay. At about 0700, whales were reported in Hanalei Bay (Braun 2005; Cook & Fujimoto, 2004). After 0700, witnesses reported that the PEPE were repeatedly approached by numerous swimmers and boaters (Cook & Fujimoto, 2004). At 1645, the RIMPAC Battle Watch Captain received a call from a Hawaiian representative to the National Marine Fisheries Service (NMFS) reporting sighting of as many as 200 melon-headed whales in Hanalei Bay. At 1647, the Battle Watch Captain directed all ships to cease all active sonar transmissions. At all times across the day, the sonar source was more than 20 nmi from Hanalei Bay.

In summary, witness reports place the whales in the bay at about 0700 on July 3, and RIMPAC sonar exercises were initiated at 0645 more than 25 nmi to the NNW, leaving a window of approximately 15 minutes in which the location and behavior of the PEPE pod was unknown with respect to the RIMPAC units. After 0700, witnesses reported that the PEPE were repeatedly approached by numerous swimmers and boaters, thereby introducing a potential alternative explanation for any behavior that may have been reported. On July 4, the pod was herded out of the bay by the public using a woven-together strand of morning glory vines (Braun, 2005; Fujimoto, 2004). No adult whales had grounded. On the following day (July 5), however, a small calf was found dead on shore. A NOAA necropsy reported that the calf died of starvation (Faris, 2004).

Natural History of Melon-headed Whales in Hawaiian Waters

Melon-headed whales are a small-sized toothed whale (odontocete) with a subtropical/temperate cosmopolitan distribution, and sighted routinely in Hawaiian waters (Schallenberger, 1981). In annual March-April aerial surveys of nearshore waters from 1993 to 2003, Mobley reported five pods of PEPE, one off Kauai, two off Oahu/Maui Nui, and two off Hawaii Island (Figure D-8) (Mobley et al. 2000; Mobley 2004). Aerial survey transects were confined to waters within approximately 25 nmi from shore; thus, the number of pods may be taken as a conservative estimate. Baird et al. (2003) reported three melon-headed whale pods, one sighted off windward Kauai in the vicinity of Hanalei Bay, one off leeward Oahu, and one off leeward Hawaii Island during shipboard surveys in May-June 2003. Because they utilize nearshore waters across all of the main Hawaiian Islands, PEPE routinely are exposed to sonar, ship movement, and other maritime activity associated with various ports. They are believed to feed on mid-water squid and fish (Perryman et al., 1994; Shallenberger 1981), but no data exist on whether they have prey preferences or diurnal or nocturnal feeding preferences. Pod sizes typically exceed several dozen individuals, with pods of 100 individuals or more not unusual. In the Mobley et al. surveys cited above, a pod of approximately 450 individuals was sighted off the coast of the island of Hawaii. In contrast, in Hawaiian waters other “blackfish” such as pilot whales (*Globicephala* spp.), false killer whales (*Pseudorca crassidens*), and pygmy killer whales (*Feresa attenuata*), typically have pod sizes less than a dozen individuals.

PEPE strandings have been reported in Hawaii dating from 1937. During the period 1937-2002, PEPE constituted 8% of all reported strandings, with 1 on Kauai, 12 on Oahu, 2 on Maui, and 1 on the Big Island (Maldini et al., 2005). Proportions should not be interpreted as an index of pod density for island waters because there is no measure of survey effort; i.e., more may be reported for Oahu simply because of greater access to and/or use of Oahu beaches. All were single individuals, but it was not known whether the individuals had died at sea and washed ashore, or had come ashore alive. The last reported stranding involved two males which came in at Oahu about 6 months prior to RIMPAC (Nachtigall, pers. comm). Interestingly, aside from the PEPE aggregation in Hanalei, the only other report of a large nearshore aggregation dates from 1841, when a pod of 60 PEPE appeared close to shore in Hilo Bay; local residents herded the pod ashore and killed them for consumption (Peale, 1848).

Analysis

Data and Analytic Assumptions

- Environmental data: (i) Hanalei River at normal summer low-flow levels below 200 cfs; (ii) Surf at normal low summer levels; (iii) Sunrise at approx. 0553; (iv) Tide weakly bimodal, low tide at approx. 0950.
- The first sonar ping was transmitted at 0645 on July 3, from a position more than 25 nmi NNW of Hanalei Bay.
- In Hanalei Bay, the received level of first ping (0645 on July 3) was estimated to be approximately 148 dB re 1 μPa at approximately 3 kHz
- 5 knots is a good estimate for sustained swim speed for PEPE.

The unstated hypothesis underlying public concern was that the PEPE aggregated in Hanalei Bay as a form of "avoidance" of active sonar transmissions. Therefore, the analysis was focused on the period 0645-0700 on July 3, from the first ping to the first reported observations of PEPE in Hanalei Bay. Prior to that time, the whereabouts and behavior of the whales was unknown, thus analysis would be speculative at best. After that time, people began to interact with the whales, thereby introducing a potential alternative explanation for any behavior that may have been reported while the whales were in Hanalei Bay.

Findings

From a perspective of natural history, the aggregation of 100-200 PEPE in Hanalei Bay was an unusual occurrence and certainly is worthy of comment. There is no evidence that the whales would have beached themselves with or without the actions of people on-site. The calf may have died and washed up on the beach, or it may have been alive when it beached. Naturally occurring mortality rates for this species in the Pacific are not known (Caretta et al., 2004). However, with 16 recorded strandings in the Hawaiian Islands resulting in mortality between 1937-2002, essentially one event every 4 years (Maldini, Mazzuca and Atkinson, 2005), such a stranding-related mortality is not unusual. Moreover, necropsy by NOAA veterinarians reported the calf found dead on the beach on July 5 had died of starvation (Faris, 2004).

In Hanalei Bay, the received level of first ping (0645 on July 3) was estimated to be approximately 148 dB re 1 μPa at approximately 3 kHz. This very likely would have been audible to the whales, given auditory detection thresholds of most odontocetes. The first sonar ping was more than 25 nmi NNW of Hanalei, 15 minutes before PEPE were reported in the bay. If a 5 knot swim speed for 15 minutes on a straight line toward the active sonar source is assumed, the pod would have been a little more than 1 nmi north of the Bay (i.e., more than 23 nmi from the RIMPAC units) at time of first ping. If the pod was 1.5 nmi closer to the sonar source, the estimated received levels increase only a fraction of a dB. In contrast behavioral change has been reported in captive bottlenose dolphins (*Tursiops truncatus*) and beluga whales (*Delphinapterus leucas*) (Finneran & Schlundt, 2004) when exposed to 3 kHz tones at measured levels of 184 dB re 1 μPa and higher. Moreover, sonar transmission ceased at 1647 on July 3. If the pod was in the bay to avoid sonar, termination of sonar should have "released" the pod to seek open water after that time, but the pod remained in Hanalei Bay well into July 4. Based on previous history, the vast majority of stranding incidents suspected to be caused by exposure to sonar have nearly all involved beaked whales, mainly Cuvier's beaked whale (ICES, 2005). Though several other species have been involved in some cases (e.g., 2000 Bahamas incident) none of these prior incidents involved PEPE (see Table 4.2.1.1 in ICES, 2005).

The findings presented here are limited by sparse data. Measured received levels of the sonar ping(s) or measured ambient sound levels in or nearby Hanalei Bay are unknown and thus a signal to noise ratio cannot be calculated. Accurate speculation about signal detection requires both data, in addition to the knowing auditory thresholds for melon-headed whales. There is no information regarding the location and/or behavior of the PEPE prior to 0700 on July 3. If the pod was in the Bay prior to 0645, then speculation of "sonar avoidance" would be moot.

If “sonar avoidance” is the hypothesis, then a pod could swim in any direction from this location to accomplish lowered sound levels. Thus it is not parsimonious to assume that a pod of PEPE in the channel would swim specifically to Hanalei Bay to reduce sound levels. However, when sonar exercises first began on July 2, Hanalei Bay was in “sound shadow” as noted earlier in this report; thus one cannot rule out the hypothesis that the PEPE may have first encountered the signals to the south, then swam north to avoid the sound.

Another untestable speculation is that the PEPE had “mistaken” the sonar ping for a source they usually avoided, such as the calls of killer whales. No amount of analysis could allow this hypothesis to be reliably evaluated, because it makes substantial assumptions that (i) the PEPE were unable to perceive the acoustical differences between killer whale calls and the sonar pings; (ii) the pod in question had prior experience with killer whale predation; and (iii) their behavioral response to killer whales would be to trap themselves in a narrow embayment.

NOAA consultant veterinarian Robert Braun was quoted as saying that “the pod's arrival could have been caused by several factors among which include biotoxins, algae blooms, or even a sick or dead member of the group” (Fujimoto, 2004); the latter might be related to the calf which was found dead on July 5.

Conclusion

Although it is not impossible, it is unlikely that sonar caused the aggregation of melon-headed whales in Hanalei Bay, the cause of the event remains undetermined. Appearance of melon-headed whales nearshore, as occurred on July 3 at Hanalei Bay, is not a typical occurrence. The only other report of a large nearshore aggregation dates to 1841. Existing data can neither refute nor support a hypothesis that avoidance of sonar caused the whales to aggregate, but a similar event has happened at least once before, apparently from natural causes.

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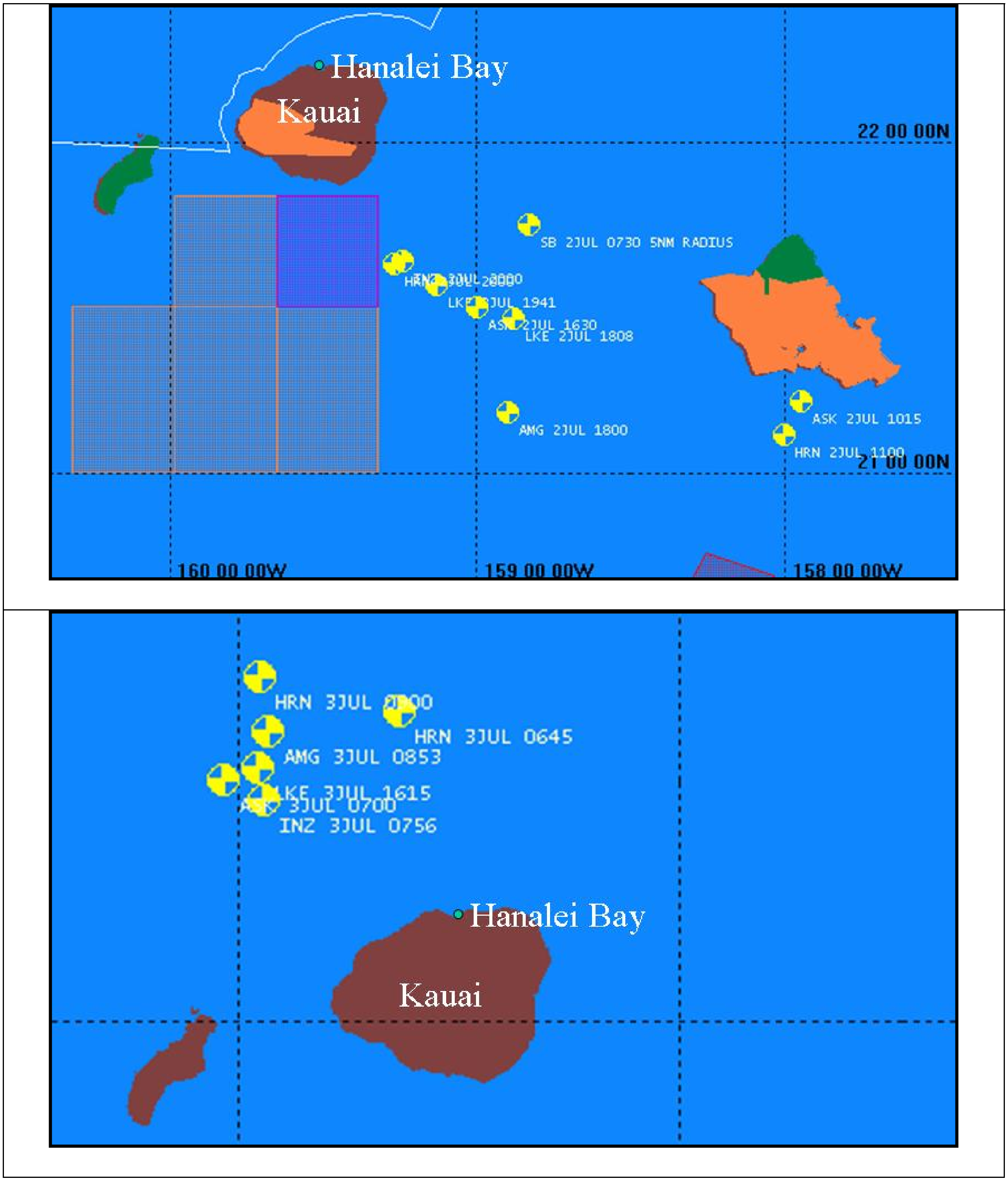


Figure D-7. Locations of RIMPAC 2004 active sonar transmissions for the July 2 timeframe are illustrated in the top panel, and for the July 3 timeframe in the bottom panel.

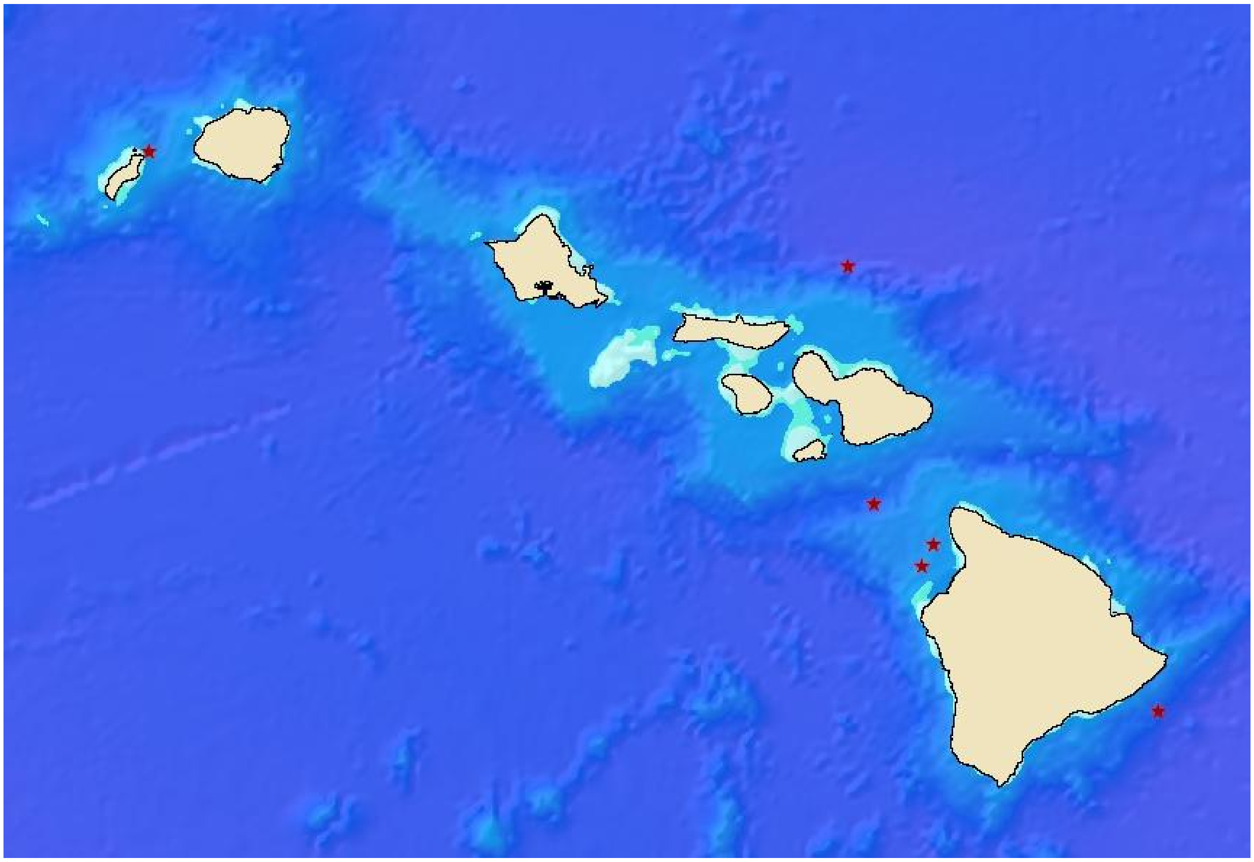


Figure D-8. Locations of five melon-headed whale pods sighted by Mobley during aerial surveys from 1993 to 2003. Note that two sightings off Kona/Kohala coast were the same pod.

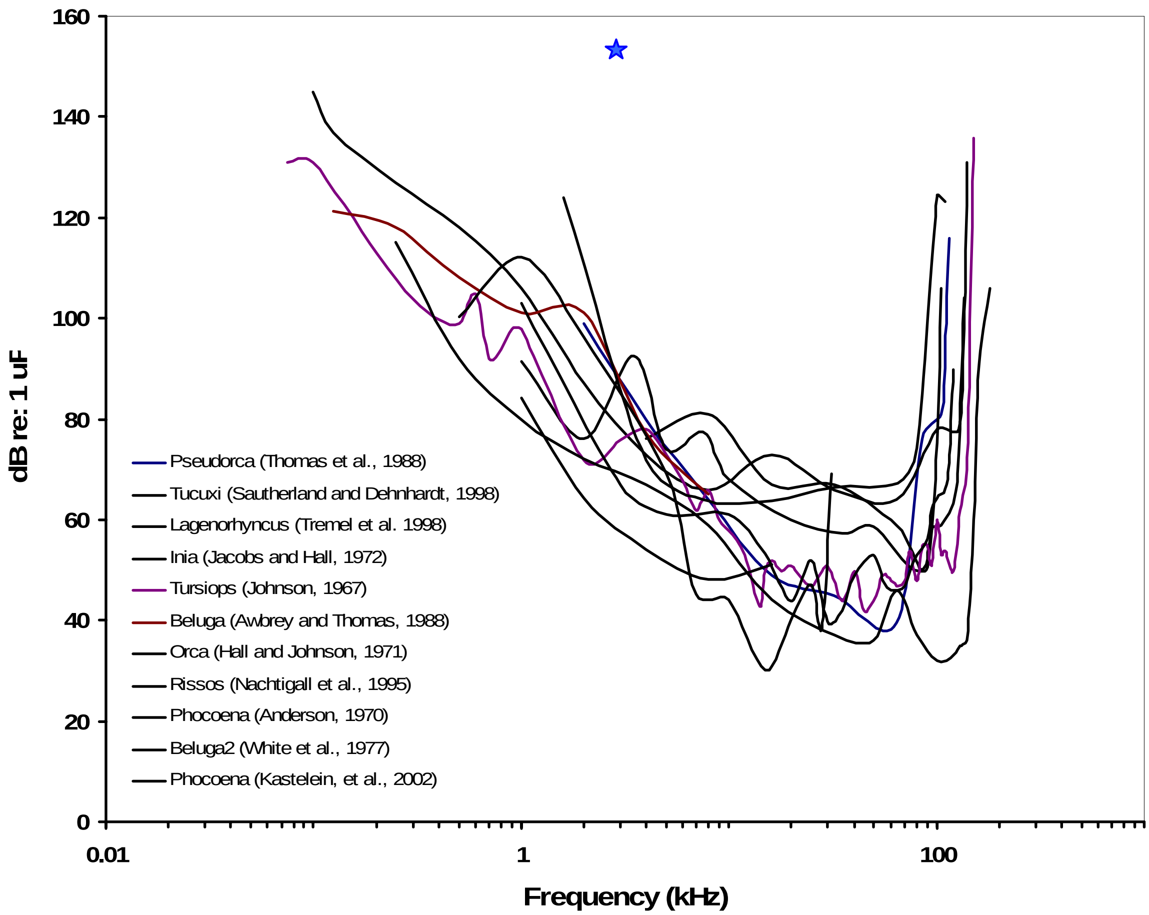


Figure D-9. Auditory thresholds measured for several species of odontocetes. The estimated peak received level of the first ping at 0645 on July 3 is indicated by the blue star.

APPENDIX E—KEY REFERENCES

Text and/or figures from key references are included in this Appendix.

Example of layout within this Appendix:

(1) Text from the 2006 RIMPAC Supplement that contains the key reference, such as described in the RIMPAC PEA, (Section 2.2.15, pg 2-26)(Appendix E, 1) is listed first.

RIMPAC PEA Section 2.2.15—Humanitarian Assistance Operation/Non-combatant Evacuation Operation (HAO/NEO)

The text or figure from the referenced document is included as shown here.

(1) The HAO/NEO activities are described in the RIMPAC PEA (Section 2.2.15, pg 2-26) as follows: Return to page 2-6

RIMPAC PEA Section 2.2.15—Humanitarian Assistance Operation/Non-combatant Evacuation Operation (HAO/NEO)

Purpose—To provide training in implementing humanitarian assistance in an increasingly hostile setting, ultimately requiring evacuation of personnel and troops.

Description—HAO/NEO training exercises involve approximately 150 personnel and troops and specialists who initially provide assistance to civilians and then evacuate the civilians when necessary. This scenario could also be used to simulate a prisoner-of-war camp or place where people are interned. Groups could be interrogated and housed before shipping to another location. Direct action is also included in the HAO/NEO description because it involves a similar number of troops. The direct action exercise is much quicker and involves approximately 50 personnel and 150 troops who gain access to an area by boat or helicopter, storm the location, recover the mission target, and return to their units.

Assets—HAO/NEO exercises use trucks, helicopters, Landing Craft, Air-cushion (LCAC), Utility (LCU) and/or Combat Rubber Reconnaissance Craft (CRRC) to shuttle supplies. Evacuations may be made using helicopters, and/or LCAC vehicles. Direct actions may use CRRCs, Rigid Hull Inflatable Boats (RHIBs), trucks, and/or helicopters. See section 2.2.20 for a description of the CRRC, RHIB, LCAC, and LCU. Existing building and facilities are utilized to the extent practicable, but in some instances, tents and other temporary structures may be utilized.

Location—Marine Corps Base Hawaii (figure 2-4) is used for HAO/NEO and direct action training. Marine Corps Training Area Bellows/Bellows Air Force Station and Kahuku Training Area could also be used for HAO/NEO. HAO/NEO is not scheduled for RIMPAC 02.

Duration—The HAO/NEO exercise lasts for approximately 4 days. The direct action exercise would be several hours.

Standard Procedures—The HAO/NEO exercise typically takes place at existing buildings and facilities. For example, on Marine Corps Base Hawaii existing designated areas of Hale Koa/West Field beach would be used for helicopters and the LCAC landings. RIMPAC participants would use training overlays that identify the landing area and any nearby restricted areas or sensitive biological and cultural resource areas in the vicinity of the exercise.

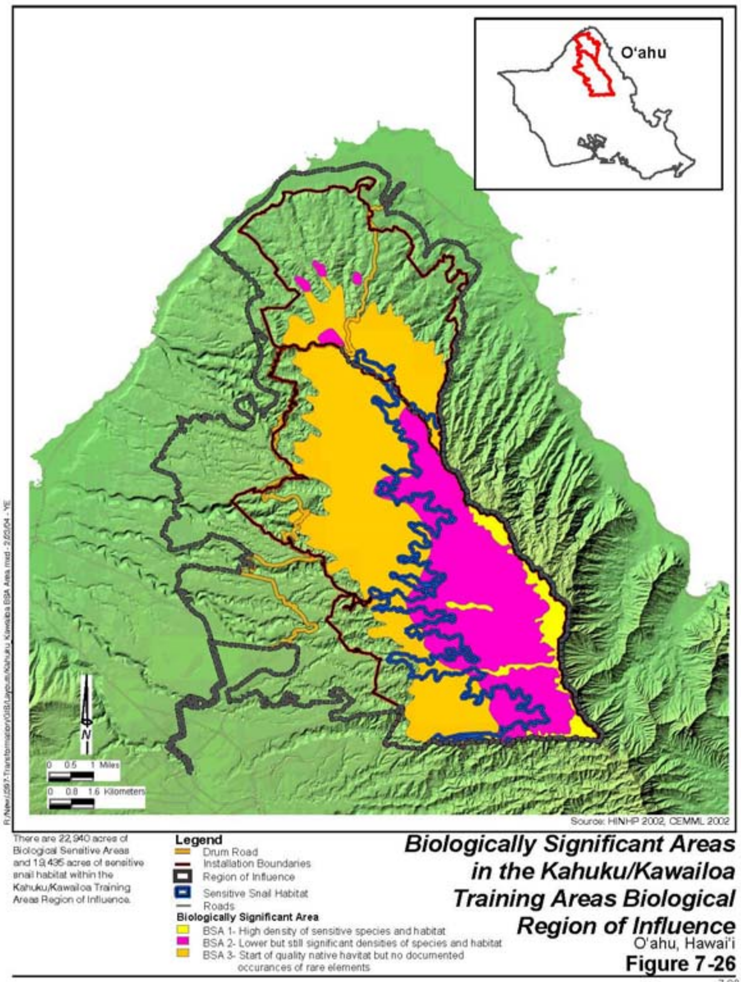
(2) On Niihau, the exercise would involve a limited number of participants (approximately 20), similar to the special warfare operations training events analyzed in the RIMPAC PEA (Section 2.2.17, pg 2-31) (Appendix E, 2). Return to page 2-7

RIMPAC PEA Section 2.2.17—Special Warfare Operations (SPECWAROPS)

Description—SPECWAROPS are performed by the U.S. Navy and the U.S. Marines. Some of the terminology used is different, but the types of activities are similar. The U.S. Marine terms are in parentheses. Activities include special reconnaissance (SR) (reconnaissance and surveillance [R&S]) Combat Search and Rescue (CSAR) (helicopter raids, boat raids), and Direct Action (DA) Tactical Recovery of Aircraft and Personnel (TRAP). SR (R&S) units consist of small special warfare unit and utilize helicopters, submarines, and CRRC to gain covert access to military assets, gather intelligence, stage raids, and return to their host units. Reconnaissance inserts and beach surveys are often conducted before large-scale amphibious landings and can involve several units gaining covert access using a boat. CSAR (TRAP) operations are similar to SR (R&S), but the mission is to locate and recover a downed aircrew. DA missions consist of an initial insertion, followed by the helicopters/boats inserting additional troops to take control of an area. The helicopters may land for refueling.

Standard Procedures—The purpose of most special warfare exercises is to operate undetected. The exercises generally involve fewer than 20 troops and have minimal interaction with the environment. During amphibious inserts the crews follow established procedures, such as having a designated lookout watching for other vessels, obstructions to navigation, marine mammals (whales or monk seals), or sea turtles. The troops will review training overlays that identify the insertion points and any nearby restricted areas. Sensitive biological and cultural resource areas are avoided by the SPECWAROPS troops (Pohakuloa Training Area, External Standing Operating Procedures, Annex T—Environmental; and table 4-2, Training Guidelines for Resource Protection—All Oahu Training Areas). (U.S. Army Garrison, Hawaii, and U.S. Army Corps of Engineers, 1997a)

(3) *The delineation of the "sensitive ecological areas" at Kahuku Military Training Area has changed since preparation of the RIMPAC PEA based on new information in the Stryker Brigade EIS (U.S. Army 2004, Figure 7-26).* Return to page 2-8



(4) As described in Section 4.1.12, pg 4-21 of the RIMPAC PEA (Appendix E, 4), the Special Warfare Operations (SPECWAROPS), Humanitarian Assistance/Disaster Relief **(**HA/DR), and HAO/NEO activities would involve training events that are non-intrusive in nature, and all participants would follow the training guidelines set forth in the Ecosystem Management Plan Report, and therefore there would be no impacts to biological resources.

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RIMPAC PEA Section 4.1.12—KAHUKU TRAINING AREA, Oahu

4.1.12.1 Airspace—Kahuku Training Area, Oahu—HAO/NEO, HA/DR, SPECWAROPS

Activities entail no use of controlled airspace other than localized use of rotary wing aircraft within predefined areas. No impact to airspace has been identified.

4.1.12.2 Biological Resources—Kahuku Training Area, Oahu—HAO/NEO, HA/DR, SPECWAROPS

Potential SPECWAROPS activities include a reconnaissance and survey mission and a tactical aircrew recovery operation. Potential HA/DR and HAO/NEO exercises would utilize existing open areas and facilities. Some temporary structures including tents may be utilized. All of these operations are non-intrusive in nature. All participants would follow training guidelines (table 4-2) set forth in the Ecosystem Management Plan Report. (U.S. Army Garrison, Hawaii, and U.S. Army Corps of Engineers, 1998a). Therefore, there would be no impacts to biological resources due to proposed RIMPAC activities in the Kahuku Training Area.

4.1.12.3 Cultural Resources—Kahuku Training Area, Oahu—HAO/NEO, HA/DR, SPECWAROPS

There would be no unmonitored ground-disturbing activities, land clearing, or use of vehicles off existing trails and roads. All personnel entering the Kahuku Training Area would adhere to the training guidelines presented in the Ecosystem Management Plan Report (U.S. Army Garrison, Hawaii, and U.S. Army Corps of Engineers, 1998a). Therefore, no impacts to cultural resources within the Kahuku Training Area are anticipated.

(5) Ongoing RIMPAC activities in the open-ocean area were analyzed in the RIMPAC PEA (Section 4.1.19, pg 4-28) (b) and the 2004 Supplement (Section 4.1.19, pg 4-5) (c). Return to page 3-4

RIMPAC PEA 4.1.19—OCEAN AREA, Hawaiian islands

4.1.19.1 Airspace—Ocean Area, Hawaiian Islands—C2, SAMEX, AAMEX, ASMEX, SSMEX, ASWEX, MINEX, STWEX, GUNNEX, SINKEX, SPECWAROPS, SUBOPS

RIMPAC exercises occur routinely within existing Restricted Areas and Warning Areas under the control of PMRF and FACSFACPH. For operations including 10 or more aircraft, the airspace manager submits a NOTAM to the affected Flight Service Station and includes this information to the airfield Air Traffic Information Service (U.S. Army Garrison, Hawaii, 1996).

The ongoing, continuing Fleet Training Exercises, including RIMPAC activities, would continue to utilize the existing overwater airspace. No new special use airspace proposal or any modification to the existing special use airspace is contemplated to accommodate continuing mission activities. Consequently, no new impacts to the airspace over the open ocean have been identified from RIMPAC activities (Pacific Missile Range Facility, Barking Sands, 1998).

4.1.19.2 Biological Resources—Ocean Area, Hawaiian Islands—SAMEX, AAMEX, ASMEX, SSMEX, ASWEX, MINEX, STWEX, GUNNEX, SINKEX, DEMO, SUBOPS

The potential for any harm to whales, monk seals, or sea turtles from the various RIMPAC exercises is remote. Personnel are aware that they are not to harm or harass whales, monk seals, or sea turtles. As part of the required clearance before an exercise, the target area must be inspected visually and determined to be clear. The required clearance zones at the target areas, and exercises within controlled ranges at PMRF, keep the risk to whales, monk seals, or sea turtles remote.

Open ocean clearance procedures are the same for live or inert ordnance. Whenever ships and aircraft use PMRF's range for missile and gunnery practice, the weapons are used under controlled circumstances involving clearance procedures to ensure whales, monk seals, or sea turtles are not present in the target area. These involve, at a minimum, a detailed visual search of the target area by aircraft reconnaissance, range safety boats, and range controllers supplemented by radar and the hydrophones on the range. Ordnance cannot be released until the target area is determined clear. Operations are immediately halted if whales, monk seals, or sea turtles are observed within the target area. Operations are delayed until the animal clears the target area. All observers are in continuous communication in order to have the capability to immediately stop the operations. The exercise can be modified as necessary to obtain a clear target area, or it is canceled. All of these factors serve to avoid the risk of harming whales, monk seals, or sea turtles.

The weapons used in most missile, GUNNEX, and SINKEX exercises poses little risk to whales, monk seals, or sea turtles unless they were to be near the surface at the point of impact. Both 50 caliber machine guns and the close-in weapons systems exclusively fire non-explosive ammunition. The same applies to larger weapons firing inert ordnance for training exercises. These rounds pose a risk only at the point of impact. The use of explosive ordinance or an explosion from a DEMO activity as a part of a SINKEX would have a higher potential to impact marine species. Target area clearance procedures would again reduce this risk.

Targets are launched from PMRF downrange into Warning Areas W-186 and W-188 as targets for surface ship anti-air warfare training. The actual area for engaging the drone as a target is well outside the 183-meter (100-fathom, or 600-foot) depth. Upon completion of the exercise, recoverable drones would be retrieved and refurbished for later use.

The potential for any harm to marine mammals (especially whales or monk seals) or sea turtles from targets or expended munitions is remote. PMRF clearance procedures make it highly unlikely that marine mammals or sea turtles could remain on the target area undetected for very long. All observers are in continuous communications and have the capability to immediately delay or suspend the operations. An exercise is immediately halted if marine mammals or sea turtles are detected in a target area. For a marine mammal or sea turtle to be injured, it would have to enter the target area undetected and then surface at the exact point where a projectile, spent missile, or spent target landed. A marine mammal or sea turtle might momentarily change its behavior if overflown by a drone at low altitude, but this effect would be a random, transitory event. There is no information presently available which indicates any indirect impacts from these types of activities on marine mammals or sea turtles. (Pacific Missile Range Facility, Barking Sands 1998)

Anti-submarine warfare is the primary role for U.S. Navy patrol aircraft and anti-submarine warfare helicopters. Anti-submarine warfare aircrews must practice using sensors, including electro-optical devices, radar, magnetic anomaly detectors, sonar (including helicopter dipping sonar and both active and passive sonobuoys) in both the deep and shallow water environment. Magnetic anomaly detection systems and dipping sonar must be employed at low altitude to be effective. The potential for operations having harmful effects on whales, monk seals, or sea turtles is extremely small. The U.S. Navy has conducted these operations in the Hawaiian Islands for decades and is unaware of any harmful effects on whales, monk seals, or sea turtles. Aircrews are trained to visually scan the surface of the water for anomalies. Due in part to this additional emphasis on visual scanning and the availability of extra crew members to conduct such searches, it is unlikely that whales, monk seals, or sea turtles would be undetected when the aircraft are flying at lower altitudes. If whales, monk seals, or sea turtles are detected, the flight path can be adjusted to meet the avoidance requirements.

The use of sonobuoys is generally limited to areas outside 183 meters (100 fathoms, or 600 feet). Before dropping sonobuoys, the crew visually determines that the area is clear. Although the altitude at which buoys are dropped varies, the potential for drift during descent generally favors release at lower altitudes, where visual searches for whales, monk seals, or sea turtles are more effective. When the sonobuoy is released, a small parachute retards its entry into the ocean so that it sinks to less than 3 meters (10 feet) before it floats back to the surface. Location of buoy drops, visual search, and the slow rate of descent dramatically reduce the possibility of either injuring or having any effect on whales, monk seals, or sea turtles.

The very low power of the battery-driven active sonobuoy ensures that the likelihood of injury to whales, monk seals, or sea turtles from the sonar is small. The only potential effect would be for the whales, monk seals, or sea turtles to detect this low power pulsed signal and avoid it.

Whenever aircraft use the ranges for air anti-submarine warfare exercises with inert torpedoes, the weapons are used under controlled circumstances involving procedures to ensure whales, monk seals, or sea turtles are not present in the target area. These involve, at a minimum, a detailed visual target area search by the aircraft releasing the weapon and additional chase aircraft (as necessary), range safety boats, and range controllers. Weapons cannot be released until the target area is determined clear. Operations are immediately halted if whales, monk seals, or sea turtles are detected in the target area. All observers have the capability to immediately delay or suspend the operations. The exercise can be modified as necessary to obtain a clear target area, or it is canceled. These controls are additive factors to ensure that the chance of injuring whales, monk seals, or sea turtles is remote.

SUBOPS in open ocean areas, including existing underwater training areas between the islands of Maui, Lanai, and Molokai, would follow open ocean clearance procedures to ensure the activity would not adversely impact marine mammals and sea turtles. The firing and tracking of non-explosive torpedoes in these training areas would not result in any significant adverse impacts to biological resources.

4.1.19.3 Safety and Health—Ocean Area, Hawaiian Islands—SAMEX, AAMEX, ASMEX, SSMEX, ASWEX, STWEX, GUNNEX, SINKEX, SPECWAROPS, DEMO, SUBOPS

All PMRF- and FACSFACPH-controlled fleet training activities that occur over the open water would continue to be conducted mainly in Warning Areas and Restricted Airspace. Range Safety officials ensure the safe operation of projectiles, targets, missiles, air operations, and other hazardous fleet training activity in controlled areas. The range safety procedures avoid risks to the public and operations. Before any operation is allowed to proceed, the overwater target area is determined to be clear using inputs from ship sensors, visual surveillance of the range from aircraft and range safety boats, radar data, and acoustic. In addition, prior to conducting any training on PMRF, the operation must obtain PMRF safety approval before proceeding, covering the type of weapon, type of target, speed, altitude, debris corridor, and surface water hazard area (Pacific Missile Range Facility, Barking Sands, 1998).

Since the target areas are cleared of personnel prior to any operations being conducted, the only public health and safety issue is if an operation exceeds the safety area boundaries. Risk to public health and safety is reduced by providing termination systems on some of the missiles and by determining that the target area—based on the distance the system can travel for those missiles without flight termination (typical air-to-air missile)—is clear. In the cases where a system does not have a flight termination, the target area is determined clear for unauthorized vessels and aircraft, based on the flight distance the vehicle can travel, plus an 8-kilometer (5-mile) area beyond the system performance parameters (Pacific Missile Range Facility, Barking Sands, 1998).

In addition, all activities must be in compliance with DoD Directive 4540.1 and OPNAVINST 3770.4A, which specify procedures for conducting aircraft operations and for missile/projectile firing, namely the missile/projectile “firing areas shall be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity.”

Missile training exercises occur routinely during daylight hours within Restricted Area R-3101 and Warning Area W-188 under the control of PMRF. The DoD takes every reasonable precaution during the planning and execution of the operation of training exercises to prevent injury to human life and wildlife or damage to property. Specific safety plans are developed to ensure that each hazardous operation is in compliance with applicable policy and regulations and to ensure that the general public and range personnel and assets are provided an acceptable level of safety. For missile and weapons systems, PMRF Safety establishes criteria for the safe execution of the test operation in the form of Range Safety Approval and Range Safety Operational Plan documents, which are required for all weapon and target systems using the Warning Areas. These include the allowable launch and flight conditions and flight control methods to contain all the munitions and missile within the predetermined target areas, ordnance drop zones, and jettison areas that have been determined to be clear of nonessential personnel and aircraft (Pacific Missile Range Facility, Barking Sands, 1998).

The impacts of missile training exercises on safety and health are not expected to be different for RIMPAC training than for routine training activities customarily conducted in open water training areas.

All DEMO activities associated with a SINKEX are conducted in accordance with COMNAVSURFPAC Instruction 3120.8D (Department of the Navy, 1993). No impacts to safety and health from RIMPAC DEMO activities are anticipated.

4.1.19.4 Water Resources—Ocean Area, Hawaiian Islands—SAMEX, AAMEX, ASMEX, SSMEX, ASWEX, STWEX, GUNNEX, SINKEX, DEMO, SUBOPS

The National Aeronautical and Space Administration conducted a thorough evaluation of the effects of munitions and missile systems that are deposited in seawater. It concluded that the release of hazardous materials aboard munitions and missiles into seawater would not be significant. Materials would be rapidly diluted and, except for the immediate vicinity of the debris, would not be found at concentrations identified as producing any adverse effects. The Pacific Ocean depth in the vicinity of the target area is hundreds of meters (feet) deep, and consequently the water quality impact from soluble materials is expected to be minimal. Any area affected by the slow dissolution of the propellant would be relatively small due to the size of the target drone motor and/or missile propellant pieces relative to the quantity of seawater (Pacific Missile Range Facility, Barking Sands, 1998).

The RIMPAC exercises have not resulted in adverse impacts on water resources in the vicinity.

(6) Ongoing RIMPAC activities in the open-ocean area were analyzed in the RIMPAC PEA (Section 4.1.19, pg 4-28) (5) and the 2004 Supplement (Section 4.1.19, pg 4-5) (6).

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2004 Supplement—Section 4.1.19 Ocean Area, Hawaiian Islands

The additional RIMPAC activities in the ocean areas of the Hawaiian Islands would not foresee ably result in impacts on resource areas such as air quality, airspace, cultural resources, geology and soils, hazardous materials and waste, land use, noise, and socio-economics. Therefore, these resource areas are not discussed.

4.1.19.2 Biological Resources—Ocean Area, Hawaiian Islands GUNNEX, MCM, Other Activities

4.1.19.2.1 GUNNEX

Potential impacts to marine mammals and sea turtles within the BARSTUR target area were analyzed in Section 4.1.19.2 of the RIMPAC PEA, concluding that the potential for harm is very remote. The ordnance used during this proposed activity is significantly smaller in size and explosive impact (155 mm rounds, up to 15.4 lb [7 kg] NEW) than other ordnance used on PMRF (MK80 series live and inert bombs, 117 to 945 lb [53 to 429 kg] NEW), which has not resulted in adverse impacts on the biological resources at PMRF. Furthermore, the addition of this proposed GUNNEX would not increase the risk of effects to marine mammals and sea turtles because PMRF's range clearance procedures would remain in force. The rounds fired by the howitzers pose little risk to marine mammals or sea turtles because the greatest risk to marine mammals and sea turtles near the surface is at the site of impact. PMRF range clearance procedures make it highly unlikely that marine mammals and sea turtles could remain within the target area undetected for very long, and firing will be paused or postponed should a marine mammal or sea turtle be detected until the animal voluntarily leaves the area.

4.1.19.2.2 MCM

The inert shapes and mine detection equipment to be used in the additional RIMPAC MCM activities at Penguin Bank, the shallow water training area and the MCM operating area would be clean and free from residual materials and invasive species from prior use, and no environmental effects on biological resources are anticipated. There would be no impact to coral reefs or fisheries since they would be deployed on sand/rubble bottom and there is a low probability of coral presence at the depths at which the shapes will be placed.

The shapes deployed and collected as part of the proposed MCM exercise would have no effect on any marine mammal or on the Hawaiian Islands Humpback Whale National Marine Sanctuary. These activities have been reviewed as part of the Hawaiian Islands Humpback Whale National Marine Sanctuary EIS (National Oceanic and Atmospheric Administration, 1997). The shapes and mine detection equipment will be inert, clean, free from invasive species and placed in the ocean from surface craft. Since the shapes will rest on the ocean bottom, they would pose no entanglement hazard to marine mammals and sea turtles. High frequency, low-power sonar systems would be used to locate the shapes. These systems are comparable to existing commercial fish locating devices. There is no historical record of any impact to mammals or sea turtles. The systems are safe and frequently used in the presence of humans in mine detection. These systems will not affect marine mammals or other biological resources in the open ocean.

The UUV and USV to be deployed in support of the MCM activities in the ocean areas of the Hawaiian Islands will have no effect on marine mammals or other protected species. The USV would be deployed and controlled from surface assets and be operated in accordance with federal law protecting threatened and endangered marine mammals and sea turtles and the RIMPAC 2004 Operational Order. Because of the UUV's slow speed and quiet operation, it is not expected to affect any biological resources in the ocean area.

4.1.19.3 Safety and Health—Ocean Area, Hawaiian Islands—GUNNEX, Other Activities

4.1.19.3.1 GUNNEX

The additional GUNNEX activities proposed for RIMPAC include the howitzer exercise at PMRF, which would result in expended munitions and projectiles entering the open Ocean environment within established Warning Areas. The safety and health impacts of GUNNEX activities are discussed in the RIMPAC PEA. In summary, PMRF Range Safety officials ensure the safe operation of any hazardous fleet training activity in controlled areas. Target areas are cleared of personnel prior to operations. Therefore, no impact to human safety and health are anticipated from the additional RIMPAC GUNNEX activities.

4.1.19.3.2 Other Activities

The Seaglider will not adversely impact humans or the marine environment. The greatest potential risk is that the Seaglider will not be recovered. Its batteries pose no threat to humans in the event it were lost and recovered by civilians because they are not toxic, as are other, more commonly used, lithium batteries. It is highly unlikely that Seaglider would be lost or that the batteries would leak. The project proponent (Applied Physics Laboratory, University of Washington) would program the device so that it emerges to transmit only at night, to avoid potential for casual sighting and retrieval. No impacts are expected because the vehicle and battery are clearly labeled, in case the device is inadvertently retrieved.
4.1.19.4 Water Resources—Ocean Area, Hawaiian Islands—GUNNEX Previous analyses of releases associated with munitions concluded that the impacts would not be significant because the materials are diluted in the water and are not found in concentrations considered as producing any adverse effects.

(7) As discussed in Section 4.1.1.3, pg 4-3 of the RIMPAC PEA (Appendix E, 7), potential impacts of past amphibious landings have been monitored.

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RIMPAC PEA Section 4.1.1.3—Biological Resources—Pacific Missile Range Facility (Port Allen, Makaha Ridge), Kauai—AIROPS, SAMEX, AAMEX, SSMEX, SMWEX, SPECWAROPS, DEMO, AMPHIBEX

Potential impacts of past amphibious landings have been monitored. Observations indicate that due to procedures in place at PMRF and the continuing disturbance of the beach and over-night area from past public and military use, the impact from AMPHIBEX activities would be insignificant. Within 1 hour of initiation of the AMPHIBEX landing activities, landing routes and beach areas would be determined to be clear of marine mammals and sea turtles. If any are seen, the exercise would be delayed until the animals leave the area.

DEMO activities in the near-shore environment include destruction of inert mines by detonation of less than 9.1 kilograms (20 pounds) of explosive per inert mine. Prior to actual detonation, the area would be determined to be clear of marine mammals and turtles. The radius of the cleared area is the distance at which cetacea (whales and dolphins) are subjected to the minimum measurable shift in their auditory threshold, called the onset of temporary threshold shift (onset-TTS). Sea turtles, being less sensitive, are presumed safe at this distance. The onset-TTS distance is determined in accordance with the criterion and propagation-modeling methods, REFMS, that were established from explosive impulse in shock trial of *USS Winston S. Churchill* (U.S. Department of the Navy, 2001b). That is, the more conservative (greater) distance associated with the receive level of either 83 kilopascals (12 pounds per square inch) peak-pressure or 182 decibels micro-pascal squared seconds (total energy) in any 1/3 octave band above 10 hertz. These distances have been estimated using the REFMS shock-wave propagation model for charge weights of 0.9, 2.3, and 9.1 kilograms (2, 5, and 20 pounds) with charge placement 0.3 meter (1 foot) above a reflective sandy bottom in 9.1 meters (30 feet) of water and using a conservative sound velocity profile (iso-velocity in this context). Table 4-1 shows the modeled distances for onset-TTS for the weights of 0.9, 2.3, and 9.1 kilograms (2, 5, and 20 pounds). Intermediate charge-weights were interpolated using a least-squares curve fit ($D = 318 + 734\ CW^{0.333}$, where D is the distance in feet and CW is the charge weight) (Sigurdson, 2002).

Table 5-6: Marine Mammal Area Clearance Based on Charge Weight at 9.1 Meters (30 Feet) Water Depth

Charge Weight, in kilograms (pounds)	Modeled Distance in meters (feet)	Interpolated Distance in meters (feet)	Radius of Area To Be Cleared in meters (feet)*
0.9 (2)	373.4 (1,225) (p)	378.9 (1,243)	380 (1,250)
2.3 (5)	487.7 (1,600) (e)	479.5 (1,573)	490 (1,600)
4.5 (10)		578.8 (1,899)	580 (1,900)
6.8 (15)		648.6 (2,128)	640 (2,100)
9.1 (20)	701 (2,300) (p)	704.1 (2,310)	700 (2,300)

*All numbers have been rounded for ease of understanding and application
p = determined by peak-pressure criterion; e = determined by total energy criterion

The estimated distances presented here are preliminary and are for the shallow waters off Hawaii in the planned initial exercises. They should not be applied in other contexts. The distances are intentionally conservative to compensate for various known factors that have not been exactly measured. Pending the outcome of research, such measures may become known and the values may be restated in the future. The stated distance from the specific charge size would be determined to be clear of all whales, seals, and turtles before proceeding with a detonation. Standard procedures at PMRF require tethered mines to be suspended at least 3 meters (10 feet) below the surface of the water. Explosive charges on or near the shallow water bottom would be placed in sandy bottom areas away from exposed reefs and coral. There would be a minor, localized, unavoidable loss to some fish and benthic community populations from the explosions. These shallow areas are not located in areas identified as EFH or HAPC, which occur at depths greater than 40 meters (120 feet). These steps serve to minimize the potential of detrimental impacts to biological resources. After exercises involving underwater detonations, the area would be searched for injured animals.

Special warfare operations at PMRF, including those out of Port Allen, would include reconnaissance and survey inserts (also at Makaha Ridge) and an underwater beach survey at Barking Sands. Existing cleared areas, trails, and roads would be utilized. Due to the non-intrusive nature of these activities, no impact to biological resources is anticipated.

Potential impacts of target missile launches on terrestrial and marine biological resources within the region have been addressed in detail in the Strategic Target System EIS (U.S. Army Strategic Defense Command, 1992). Based on the analyses done at that time and the effects of past target and missile launch activities, the potential impacts of target (SAMEX, AAMEX, and SSMEX) launching activities on biological resources are minimal (Pacific Missile Range Facility, Barking Sands, 1998).

Surface impacts of targets are expected to occur in offshore locations. The potential for an object or objects dropping from the air to affect marine mammals (whales or monk seals), sea turtles, or other marine biological resources is less than 10^{-6} (1 in a million) (U.S. Army Strategic Defense Command, 1992; Pacific Missile Range Facility, Barking Sands, 1998). Munitions, unrecovered targets, and sonobuoys would sink to the ocean floor.

Potential impacts resulting from SMWEX activities would result from a ship directly contacting a large marine mammal during the exercise. Given that the exercise will be conducted in a relatively shallow underwater range, approximately 46 to 107 meters (150 to 350 feet) deep, it is unlikely that large whales would be in waters that shallow, or that dolphins would be unable to avoid the relatively slow vessel. The RIMPAC OPORDER annex for environmental protection outlines procedures for collision avoidance and encounter reporting. Therefore it is highly unlikely that marine mammals would be impacted during SMWEX exercises.

AIROPS would utilize existing runways and airspace. Moorings and associated stabilizing supports, guy wires, and anchors for the airships would be placed in existing open areas. The impacts of AIROPS on biological resources would be minor and insignificant.

(8) As discussed in Section 4.1.2.1, pg 4-11 of the RIMPAC PEA (Appendix E, 8), Special Warfare Operations training events on Niihau would utilize existing openings, trails, and roads.

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RIMPAC PEA Section 4.1.2.1—Biological Resources—Niihau—SPECWAROPS

SPECWAROPS exercises on Niihau would utilize existing opening, trails and roads. Therefore, no impacts to biological resources would be anticipated.

(9) As discussed in Section 4.1.2.2, pg 4-11 of the RIMPAC PEA (Appendix E, 9), no known traditional cultural properties are located within the U.S. Navy's Mobile Operations Area on Niihau.

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RIMPAC PEA Section 4.1.2.2—Cultural Resources—Niihau—SPECWAROPS

No known traditional cultural properties are located within the U.S. Navy's Mobile Operations Area on Niihau. Personnel would take all measures to prevent discovery, including not overturning rocks or digging any soil. Helicopter lands would be in areas designated for suitability and absence of cultural resources. However, it is possible during SPECWAROPS exercises for participants to find a previously unknown site. Exercise participants would be briefed on the need to promptly notify U.S. Navy Region personnel if any cultural resources are found so the appropriate coordination could be initiated.

(10) The 2002 RIMPAC PEA and the 2004 Supplement concluded there would be no cumulative impacts from RIMPAC activities (PEA Section 4.3, pg 4-32; 2004 Supplement Section 4.3, pg 4-7) (Appendix E, 10).

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5.1 RIMPAC PEA Section 4.3 - CUMULATIVE IMPACTS

In addition to the ongoing military activities in the Hawaiian Islands area, several other programs are reasonably foreseeable at this time. The Minimum Cost Design Upper Stage program would be a joint Missile Defense Agency (formerly Ballistic Missile Defense Organization) and U.S. Air Force program that would modify the Strategic Target System vehicle. Existing facilities at KTF would be used. There would be no overlap of activities with RIMPAC exercises, and therefore cumulative impacts would not be anticipated.
The proposed enhancement of facilities and capabilities at PMRF was evaluated in the PMRF Enhanced Capability EIS (Pacific Missile Range Facility, Barking Sands, 1998). The modifications considered would support DoD Theater Missile Defense and U.S. Navy Theater Ballistic Missile Defense test and evaluation activities, including upgrading of existing facilities, construction of launch facilities, and launch of missiles. The program would potentially affect locations on Oahu, Kauai, Niihau, Kaula, Maui, and various Warning Areas. Locations on Tern Island and Johnston Atoll were dropped from the final PMRF Enhanced Capability EIS (Pacific Missile Range Facility, Barking Sands, 1998) includes RIMPAC as one of the ongoing Fleet Exercises and concluded that cumulative impacts are not expected from RIMPAC and other ongoing exercises and the proposed enhancement activities.

5.2 RIMPAC 2004 Supplement Section 4.3—CUMULATIVE IMPACTS

The foregoing sections in this chapter concluded that these additional activities would have no impact on resource areas of concern. The additional activities would take place in areas previously identified and used for military training. The activities are short-term, temporary and do not involve land acquisition, new construction or expansion of military presence in Hawaii. They are also separated in time and location from the activities evaluated in the RIMPAC PEA. Therefore, the Proposed Action will not contribute to cumulative impacts on the resource areas described above.

(11) Essential Fish Habitat (EFH) was described in Appendix E of the RIMPAC PEA (Appendix E, 11).

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5.3 RIMPAC PEA Appendix E—Marine Biological Resources

Marine Fish, Essential Fish Habitat, and Coral

Much of what is known about the biology of the deep ocean waters surrounding the Hawaiian Islands is based on limited information gleaned from studies on sport and commercial fisheries. Pelagic ocean and deep seafloor (benthic) ecosystems occur in the deep open waters beyond the neritic shallow-water zone around all the islands and on, and above, the seafloor at depths greater than 200 meters (660 feet). Pelagic ocean waters are exposed to swells, currents, and winds from all directions, generally beyond the sheltering effects of the islands. Deep currents and eddies are also associated with this zone. Sunlight is absent on the deep seafloor. Basalt and carbonate rock substrates are common on slopes, with sediments prevalent on flatter surfaces. Bottom sediments surrounding Oahu are composed largely of muds washed as organic matter (detritus) from the adjacent islands, and sand and gravel of shallow-water origin.

Phytoplankton are the only abundant plants in the pelagic zone; living plants are rare or absent on the deep seafloor. Zooplankton, fishes, squids, sea turtles, marine mammals, and various seabirds forage in neritic or pelagic waters. At depths in excess of 100 meters (330 feet), many benthic organisms live where there is little or no light and maintain themselves on detritus and planktonic organisms in the water column.

The Magnuson-Stevens Act defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. “Waters,” when used for the purpose of defining EFH, include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include historical areas of use where appropriate. Substrate includes sediment, hard bottom, underlying structures, and associated biological communities. The designation of EFH by the Western Pacific Regional Fishery Management Council was based on the best scientific data available. Careful judgment was used in determining the extent of EFH that should be designated to ensure that sufficient habitat in good condition is available to maintain a sustainable fishery and the managed species contribution to a healthy ecosystem.

National Marine Fisheries Service guidance governing implementation of the EFH amendments calls for the identification of habitat areas of particular concern. Habitat areas of particular concern could need higher levels of protection than other habitat from adverse effects, including impacts from non-fishing related activities as well as from fishing and activities supporting fishing industries. Habitats that are limited geographically or are unusually productive may be designated as reserves or sanctuaries where appropriate. Identifying potentially threatening activities to habitat areas of particular concern is a complex task, since impacts from different activities, or from the same activity repeated over time, can be cumulative throughout the ecosystem.

To manage the EFH areas, the National Marine Fisheries Service has placed the managed species in four categories: bottomfish management unit species, pelagic management unit species, crustacean management unit species, and precious coral management unit species.

Except for major commercial species, little is known about the life histories, habitat utilization patterns, food habits, or spawning behavior of most adult bottomfish and seamount groundfish species. Furthermore, very little is known about the distribution and habitat requirements of juvenile bottomfish.

The distribution of adult bottomfish is closely linked to suitable physical habitat. Unlike the U.S. mainland with its continental shelf ecosystems, Pacific islands are primarily volcanic peaks with steep drop-offs and limited shelf ecosystems. The bottomfish management unit species under the Western Pacific Regional Fishery Management Council's jurisdiction are found concentrated on the steep slopes of deep-water banks. The approximately 200-meter (660-foot) isobath is commonly used as an index of bottomfish habitat. Adult bottomfish are usually found in habitats characterized by a hard substrate of high structural complexity. Bottomfish populations are not evenly distributed within their natural habitat; instead they are dispersed in a non-random, patchy fashion.

There is regional variation in species composition, as well as a relative abundance of the bottomfish management unit species of the deep-water bottomfish complex. The target species are generally found at depths of approximately 50 to 270 meters (160 to 890 feet).

The Western Pacific Regional Fishery Management Council has designated this area as bottomfish EFH. The species designations include deep-slope bottomfish (shallow- and deepwater) and seamount groundfish complexes. Shallow-water species are those in the 0- to 100-meter (0- to 330-foot) depths. Deep-water species are those in the approximately 100- to 400-meter (330- to 1,300-foot) depths. Because of the known depth and bottom types preferred by bottomfish, and the pelagic nature of their eggs and larvae, the Western Pacific Regional Fishery Management Council has designated the water column and all bottom habitats from the shoreline to a depth of 400 meters (1,300 feet) around the Hawaiian Islands as EFH. The Western Pacific Regional Fishery Management Council has also designated all escarpments and slopes between approximately 40 to 280 meters (130 to 920 feet) as habitat areas of particular concern.

The life histories of most of the commercial, recreational, and other fish species (marketable, non-marketable, and sharks) are not well known. Most are pelagic spawners. However, the National Marine Fisheries Service has designated the marine environment from the shore to the 22-kilometer (12-nautical-mile) limit as EFH. Areas of most concern in Hawaii are escarpments, locations of high structural complexity, live coral heads and reefs, and nursery areas. Examples include coral reefs, fringing reefs, lagoons, estuaries, tidal mangrove vegetation, and seagrass beds. There are large gaps in the scientific knowledge of the basic life histories and habitat requirement for many of the species that make up the pelagic management unit species. Therefore the Western Pacific Regional Fishery Management Council has adopted a 1,000-meter (3,300-foot) depth as a lower boundary of the EFH for pelagic management unit species, and 200 meters (660 feet) from the shoreline to the outer limit of the Exclusive Economic Zone (EEZ) as the upper limit of the EFH covering the eggs and larvae of the pelagic management unit species. The EEZ extends from seaward of the state's boundary out to 370 kilometers (200 nautical miles) from land.

Spiny lobsters are found throughout the Indo-Pacific Region. All spiny lobsters in the western Pacific region belong to the family Palinuridae. The slipper lobsters belong to the family Scyllaridae. The Hawaiian spiny lobster (*Panulirus marginatus*) is endemic to Hawaii and is the primary species of interest in the Northwestern Hawaiian Islands fishery. In Hawaii, adult spiny lobsters are typically found on rocky substrate in well-protected areas, in crevices, and under rocks. The reported depth of the Hawaiian spiny lobster is from approximately 3 to 200 meters (10 to 660 feet), but is generally most abundant in waters of 90 meters (300 feet) or less. The Kona crab, family Raninidae, is taken in low numbers in the Northwestern Hawaiian Islands fishery. The Western Pacific Regional Fishery Management Council has designated the EFH for crustacean management unit species based on complexes or assemblages. The two complexes are the spiny and slipper lobster complex and the Kona crab complex.

For spiny lobster larvae, the EFH is the water column from the shoreline to the outer limit of the EEZ down to a depth of 150 meters (450 feet). The EFH for juvenile and adult spiny lobster is designated as the bottom habitat from the shoreline to a depth of 100 meters (330 feet). The Council has also designated all banks with summits less than 30 meters (95 feet) in the Northwestern Hawaiian Islands as habitat areas of particular concern for spiny lobster.

Black, pink, gold, and bamboo corals, collectively referred to as precious corals, occur in deep inter-island channels and off promontories at depths between 15 and 1,500 meters (50 and 4,920 feet). These coral species are included as management unit species in the Precious Corals Fisheries Management Plan. The Council has designated the six known beds of deep-water precious coral (pink, gold, and bamboo) as EFH for precious coral management unit species. The six known precious coral beds are located at Keahole Point, Makapuu, Kaena Point, Wespac, Brooks Bank, and 180 Fathom Bank. In addition, the agency has also designated the three black coral beds in the main Hawaiian Islands as EFH for precious coral management unit species. The three black coral beds are located between Milolii and South Point on Hawaii, Auau channel between Maui and Lanai, and the southern border of Kauai. The Council has designated three of the six known deep-water precious coral beds (Makapuu, Brooks Bank, Wespac) are designated as habitat areas of particular concern. For black corals, the Council has designated Auau channel as habitat areas of particular concern.